The FOUNDRY

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Castings Give Beauty to Magazine Racks

IN DAYS of old when gallant knights rode forth on quests of fame and honor, dragons trembled and sought lowly caves in refuge from avenging swords. Often a fair damsel was the object of the

The Gray Iron Knight Conquers Two Dragons

knight's attentions and to save her from the jaws of the dragon was his mission. In early Christian art the dragon represented evil, paganism, or plauge and was the personal representative of the devil. The myths of the middle ages tell of dragons that held cities or entire countries in a state of terror, ravaging the lives and properties of the citizens. When such a menace existed, the knight came upon the scene, killed the dragon, and rescued the damsel. We still have fair damsels in need of rescue—and a few knights who come to their aid. A visit to any department store reveals hundreds of magazine racks, good, bad, and indifferent; most of them of flimsy wooden construction. The housewife who found this beautiful rack of cast gray iron was grateful to the molder's art. The foundryman that found a new field for his product helped kill the depression dragon.

Find Where Castings Can Be Sold

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Molding

By Edwin Bremer

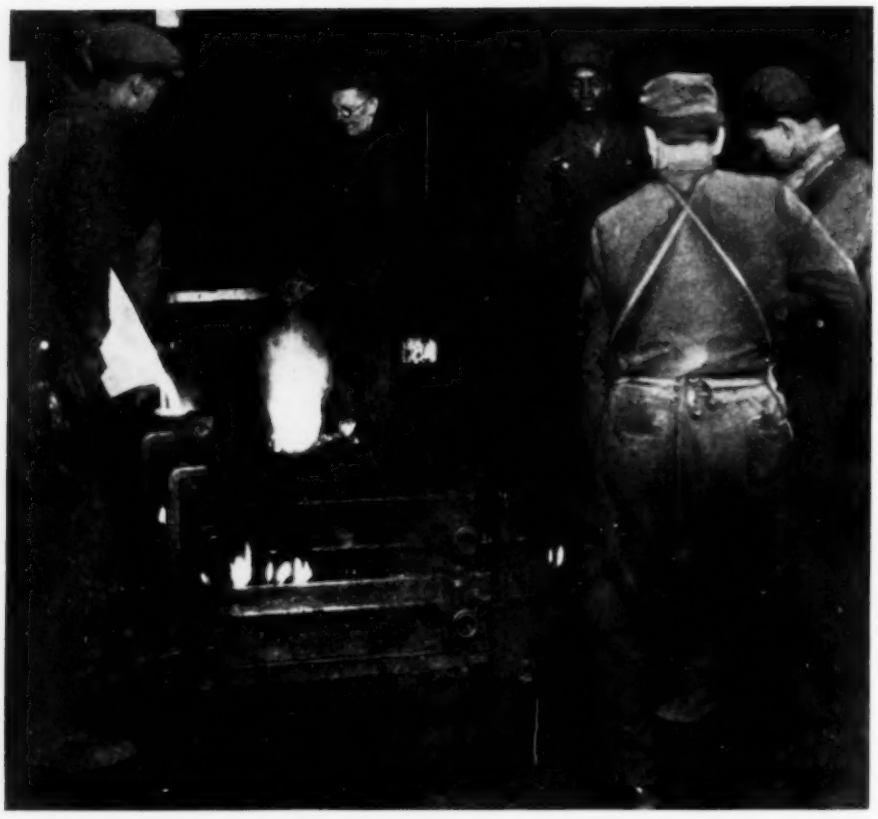


Fig. 1—Valve Seat Is Poured from a Large Ladle and a Smaller One on Opposite Corners of the Mold

FROM time to time historical data on the development of copper alloys have been published indicating that bronze and brass were accidental discoveries rather than the result of searches to harden metallic copper, which was obtained from the isle of Cyprus. Undoubtedly, due to the variations in purity of the metals and ores (or stones) used to produce the alloys, the compositions and the properties of the alloys varied to a large extent, and a considerable time elapsed before the reasons for those variations were discovered.

As knowledge on mixtures for certain properties increased, and more metals and ores became available, the applications of brass and bronze became more widespread. At first the use of copper alloys was restricted to jewelry and coins, but later it spread to the manufacture of articles for warfare, and then to tools and implements. Forging was the first method employed for working copper and its alloys. Then it was found that the metals could be cast roughly to shape and the final touches achieved by forging. Progress in the art of handling copper and its alloys brought on the development of stone and baked clay molds which could produce castings of the desired shape, and in time it was discovered that certain sands could be used for the same purpose.

With the latter development, came flexibility. The size of the castings made began to increase, and the casting of brass and bronze for a variety of purposes became an established industry which developed and flourished. Other metals and alloys for casting were developed, and in 1929, it is estimated that nonferrous castings to a value over $160,000,000 were produced in the United States.

Copper and copper alloy castings possess certain properties which adapt them to many uses. For example, the color may be varied from the pleasing red of copper to the bright yellow of brass. Commercially pure copper is an excellent conductor of heat and electricity, and that property, to a large degree, is found in its alloys. Corrosion resistance also is a property of copper and many of its alloys, as are strength and ductility. Consequently, it easily may be seen why copper and copper alloy castings are employed in both utilitarian and

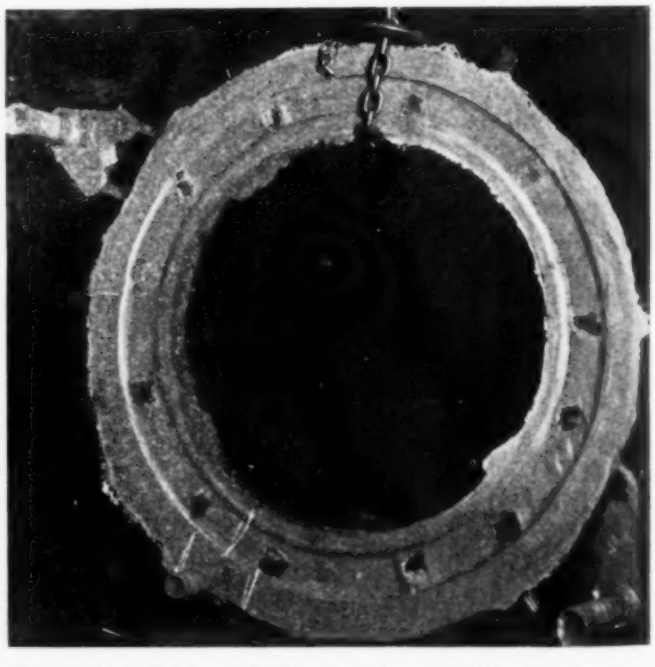


Fig. 2—View Showing the Gates, Riser and Chaplet Locations

Large Nonferrous Castings Requires Wide Experience

decorative capacities for many purposes.

While many are familiar with the making of light and medium weight castings in brass or bronze, special knowledge acquired from wide experience is required to produce heavy castings without encountering considerable grief. Melting procedure does not vary greatly from standard practice except that larger quantities of metal are handled, and when several melting units are used, care must be exercised to see that all the metal is ready at the same time. Otherwise some of the metal may be allowed to stew and absorb gases if held in the furnace, or become too cold if pulled from the fire.

Pouring Temperatures Important

Pouring temperatures are important, and while they may be lower than those employed for light and medium sectioned castings, successful results cannot be obtained if the castings are poured below certain minimum temperatures. At the same time it is not safe to go above certain maximum temperatures due to difficulties encountered from sand burning on the castings, coarse crystalline structures due to slow cooling, and possibilities of blows resulting from improper sand conditions. Some foundries making heavy copper and copper alloy castings dry all the molds, and others find that good results are obtained when the mold is skin dried to a reasonable depth.

As there are no set rules that can be applied to all heavy castings, each one has to be considered by itself. The details of molding finally adopted for each piece are gathered from a store of knowledge gained from many years experience. While it may seem that the prerequisite of experience will limit production of large nonferrous castings to a relatively few foundries, that type of work is carried on by many foundries located in different parts of the country. One foundry engaged in producing heavy copper and copper alloy castings is the Hodgson Foundry Co., Chicago, and some of the molding methods employed will be described.

Fig. 4 shows a water wheel with seven vanes made in one piece from an alloy containing 88 per cent copper, 10 per cent tin, and 2 per cent zinc, which also is called admiralty gun metal. The casting weighs about 500 pounds after machining. The pattern, and one-half of the core box are shown in Fig. 5; the core box on the right, and the pattern on the left. In molding the casting, a false cope is rammed up in a steel flask and the pattern bedded in to the parting line which is established along the upper edge

Fig. 3—The Mold with the Core in Place Ready for Closing

of the core print marked *A* in Fig. 5. Then the drag flask is placed in position, and the chaplet supports and gate plug are located in position. The chaplet supports are L-shaped pieces of ⅛-inch steel 2 inches wide. One of the legs of the supports is about 2 inches long and the other is about 4 inches long.

A layer of sand about ½-inch thick is riddled carefully on the pattern, and then a layer of backing sand is shoveled in. The sand is hand-tucked along the bars and around the gate plug, and then rammed. Another layer of sand is shoveled in and rammed and the process is continued until the edge of the casting above the vanes is reached. At that point two channels in

Fig. 4—Waterwheel Which Contains Seven Curved Vanes

the form of a V are cut from the gate plug to the casting. A well-blacked cover core is placed over those openings and the end of the gate plug. Then more sand is shoveled in, rammed into place, and the process continued until the flask is filled. After butt ramming all-over, the excess sand is struck off level.

Four Risers Used

Some loose sand is scattered over the mold and a bottom board is rubbed into place. The bottom board and two flasks are clamped tightly together, and the whole rolled over with chain slings and a chain block. After removing the clamps, the false cope is taken off, and shaken out. The flask is replaced. Then chaplet supports, an extension of the gate plug, and the riser plugs are put into position. Four risers are used and they are located on a diameter at right angles to that of the gate. Two of the risers are located on the inside rim, and two are taken off the outside rim of the casting cavity.

A ½-inch layer of sand is riddled over the face of the pattern. Gaggers are placed along the bars of the flask and a layer of sand is shoveled in. The sand is tucked around the gate and riser plugs, rammed into place, and the process continued until the flask is filled. After butt ramming, the excess sand is struck off level. The gate and riser plugs are removed, and the cope flask is lifted off to one side. Channels are cut from the riser holes located near the outer rim to the casting cavity, and the same operation is performed from the gate opening to the casting cavity. When the channels have been cut, the cope is finished all over by slicking the surface. Graphite or plumbago is brushed over the surface carefully with a large camel's hair brush, and the mold face is sprayed with molasses water.

After all operations have been completed on the cope, attention is turned to the drag. The pattern is drawn carefully from the sand as is the gate plug, and the mold face is finished in a manner similar to that employed in the case of the cope. The two graphited halves which form the core then are brought in and placed on the floor near the mold. The two parts are set up in the position they will occupy in the mold, and the molder carefully checks both halves to see that they match perfectly. After any slight adjustments, filing, etc., that may be required, several coinciding or locating marks are made on each half of the core.

Skin-dry the Mold Faces

The cores are left in position for the time being while the cope and drag molds are skin dried with a torch. Drying is continued until the surfaces of the mold can withstand scratching with the finger nail. That condition indicates that drying is deep enough to prevent the return of moisture to the mold faces during the interim between closing the mold and pouring. While the mold halves are being dried, the cores also are warmed by judicious application of the torch.

After the molds are dried sufficiently they are ready for the cores. However, before the cores can be put in, it is necessary to install chaplets between the mold face and the core to give the required metal thickness. The chaplets consist of small blocks of copper or bronze about ½ x ¾ x ¾-inch. These rest upon the chaplet supports which have been mentioned previously. Small copper plates ⅛ x 1½ x 1½-inch are centered on the chaplets to give a wider area of support to the core which rests on the chaplets. When these have been placed, the upper half of the core is removed from the lower half and placed to one side. The bottom half is picked up and placed in the mold. Then the upper half is lowered into position on the part of the core in the mold so that the locating marks on both halves coincide.

Chaplets similar to those placed in the drag are placed on the core so that they will meet the chaplet supports in the cope when the mold is closed. The method of placing the chaplets is the reverse of that mentioned in case of the drag as the copper plate is placed on the core, and the copper chaplet on the plate. When the chaplets have been placed in position, the cope is lowered into place, and the mold is clamped together. Then a runner basin is constructed over the gate opening in a section of 6-inch steel pipe. As soon as all operations have been completed, the mold is poured.

Fig. 6 shows a valve seat at the left, and a valve gate at the right. These are cast in bronze composed of 97 per cent copper and 3 per cent tin, and are hollow so that they may be water cooled. Fig. 3 is the mold, just before closing, in which the valve seat was made, and Fig. 2 shows the cope side of the casting with the sprues and risers still attached. When machined the casting weighs 500 pounds. The external diameter is 40 inches, the internal diameter, 30 inches, and it is 6 inches deep. The circular walls are ⅝-inch thick while the other two walls are ¾-inch thick.

Core Has Seven Prints

In molding the valve seat, the pattern, which contains seven core prints extending radially from the outer circumference, is laid on a bottom board. A steel flask is centered over the pattern, and 6 chaplet supports are placed on the pattern face at equal intervals. Three horn gates are used, connected to two sprues on opposite sides of the casting. One sprue is attached to a single horn gate while the other sprue is attached to the remaining two horn

Fig. 5—One-half of the Core Box and Pattern for Seven-Vaned Waterwheel

gates, which are arranged in a V-shape. The horn gates have sufficient taper or draft so that they can be withdrawn from the face of the drag after it is rolled over. They also are placed at their proper places on the pattern.

A layer of sand is riddled over the face of the pattern, and then a layer of backing sand is shoveled in and rammed into place. More backing sand is shoveled in and rammed, and the process is continued until the flask is full. After striking off the excess sand, some sand is scattered over the mold and the bottom board rubbed into position. The mold with its two boards is clamped, rolled over, and the top board removed. Then the surface of the drag mold is slicked carefully with the trowel to provide a dense smooth surface, and the cope flask is set in position.

Smooth the Cope Face

The sprue plugs are placed near the ends of the horn gates, and the riser plug is set over that point where the baffle, indicated by the break in the core in the lower right hand corner of Fig. 3, will be located. Chaplet supports and gaggers are placed in the proper positions and the mold is filled with sand as described for other molds. After striking off the excess sand, the sprue and riser plugs are removed, and the cope is lifted off to one side as shown in Fig. 3. The face of the cope is slicked with the trowel to make it dense and smooth. Attention then is turned to the drag.

The pattern is rapped evenly, and then slowly withdrawn from the sand so that the edges of the sand will not be broken. Runners or channels are cut in the face of the drag from the ends of the sprue plugs to the openings left by the horn gates after they have been withdrawn. Twelve vent scratches about 3 inches long are scratched radially from the cavity toward the center of the drag. The faces of both the drag and cope are coated with graphite and then sprayed with molasses water. The faces of the molds are skin dried until the surface can withstand scratching with the finger nail. When that condition is reached, the 6 chaplets are placed in the same number of supports in the drag, and the core is lowered into place.

Twelve chaplets as shown in Fig. 3 are placed on the top of the core, and the openings left by the core prints on the pattern are filled with molding sand. Location of the core prints is indicated in the illustration by darker narrow areas of sand radiating from the exterior of the mold cavity. The mold is closed, and clamped. Runner basins similar to those described are made and placed over the two sprue openings, and the mold is poured as shown in Fig. 1. A large bull ladle containing 400 pounds of metal is poured into the sprue opening attached to the two horn gates, while metal from a smaller crucible is poured into the sprue with the single horn gate.

Cast in Baffle Plates

The valve gate shown at the right in Fig. 6 is approximately 36 inches in diameter, and 4 inches deep with a metal thickness of 5/8-inch. Similar to the valve seat, it is hollow for water cooling. The water inlet and outlet openings are indicated by *O*, and to insure that the cooling water circulates to all points of the casting, three baffle plates are cast integral with the remainder of the casting. One baffle extends parallel to, and between the two water openings to approximately the center of the casting. The other baffles are located on each side of that baffle, and parallel to it. Those baffles extend to within 6 or 8 inches of the circular wall at either end, and cause the stream of water entering and leaving to divide and flow on both sides of each baffle.

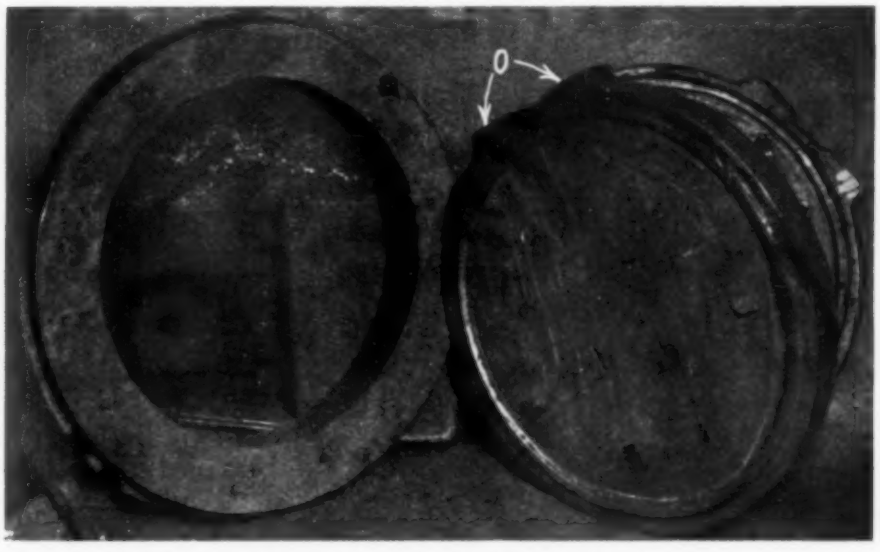


Fig. 6—Valve Seat and Gate Cast in 97 Copper-3 Tin Alloy

Fig. 7—Two-Vaned Waterwheel Weighs 1800 Pounds

Molding of the valve gates is similar to that employed for the valve seats. The baffles are formed by slots or openings in the core. Approximately 12 chaplets are used on each side of the core to support it as the core has only two prints which form the water openings. One riser is placed directly over and between the two water openings, and the mold cavity is fed with two sprues attached to double horn gates which have been described. The sprues are located on a diameter at right angles to that on which the riser is placed. The alloy used contains 97 per cent copper and 3 per cent tin.

Wheel Has Only Two Vanes

Fig. 7 is a view of a water wheel which differs considerably from that shown in Fig. 4. Instead of seven vanes it contains only two which are involute in shape. Since these vanes are 12 inches across the widest point tapering to almost a feather edge at the end, the interiors are hollow to eliminate unnecessary weight, and to provide as nearly as possible a uniform metal thickness throughout the casting. The casting weighs about 1800 pounds and is cast in the 88-10-2 alloy. The average metal thickness is about 1 inch. The cores forming the interiors of the vanes are removed through two holes about 2 inches in diameter formed by prints on each of the cores. Two of the holes for one vane are visible on the upper part of the casting in Fig. 7 while the lower part shows only one hole for the other vane.

The two-vaned waterwheel is molded quite similar to the seven-vaned wheel, and only a brief review of the methods will be given. A false cope is rammed and the pattern bedded in. Then the drag flask is set on the false cope and rammed. After putting on a bottom board and clamping, the whole is rolled over. The false cope is removed, shaken out, and the flask

(*Concluded on Page* 59)

How Declining Markets Affect Castings Costs

ACCORDING to all economists, we are entering an era of declining values. Or, as others state, the purchasing power of the dollar is increasing. Whichever view is correct, something decidedly is acting upon prices of many commodities, including those raw materials which enter into castings manufacture. As was stated in the article "Striking a Balance," presented in THE FOUNDRY of March 15, in every era of declining values, buyers can bring comparative figures to bear upon the basic structure of prices. A letter from a large buyer of castings sent to THE FOUNDRY some weeks ago raised a number of comparatives to confront foundrymen. Recognising these questions as symptoms of the times and believing that these or similar questions are being brought to bear on the sales force of foundries throughout the country, a discussion was invited from a number of notable men in the gray iron, steel, and malleable branches of the industry.

Answer the Questions

The responses from these men were a splendid indication of the modern foundryman's business ability and his understanding of the relationship between active cost elements in developing castings costs. The questions are stated in the accompanying box. Each will be discussed in turn in the following:

A prominent gray iron foundryman says:

We feel that the first question is a very logical and reasonable question, to be asked by any of our customers. As a matter of fact, we have several customers with whom we make corrections, in our casting price, every time pig iron goes up or down, $2.00 per ton. For example, if we have a customer, that is paying five cents a pound for his castings, and pig iron goes down $2.00 per ton, we will make him a reduction of 10 cents a hundred, or a new price of $4.90 per hundred. This same thing works when pig iron goes up on the same basis of 10 cents per hundred. We do not attempt to adjust a movement of one dollar a ton either up or down.

Another answer to this question from a gray iron foundryman notes:

For example, we use about a ton of pig iron for a ton of castings, and therefore, on our average run of castings the change of $1.00 per ton in the pig iron market would change our costs, actually and directly, $1.00 per ton.

That these conditions vary from time to time is evident from the third response, also from the gray iron industry.

One ton of pig iron produces about a ton and a half of castings, the reason for this being that we use a rather large percentage of steel. Therefore, it is practically impossible to make a general conclusion as to how the price of pig iron might affect the price of the casting unless you had an average of the mixtures that are used and all the castings that are produced, and even then your figure would give no specific buyer a definite basis for calculation on his work.

One malleable iron foundryman states that the pound reduction in castings price at his plant amounts to $0.00037 for each dollar per ton reduction in the price of pig iron.

The Questions

HOW does the price of pig iron per ton affect the price of castings per pound, for instance, how will $1.00 per ton change in pig iron cost affect the cost of castings in cents per pound?

How much will $1.00 per ton change in coke affect castings costs in cents per pound?

How much does $1.00 per day change in molders' wages affect the cost of castings in cents per pound?

How many pounds per day will an average molder be able to put up, say in the three different groups of light, medium and heavy castings? By light castings we mean those weighing under, say five pounds. By medium those from say, five pounds to 50 or 100 pounds and heavy castings on up to say, 2500 pounds. Of course, the type of the casting and probably the core work will have something to do with the amount but we merely want average conditions, and would like to have the data if you could give it to us.

How many pounds of good castings are obtained from one ton of melted iron? This, of course, would take into consideration the sprue, gate risers, etc., as well as normal scrap.

Another answer from a malleable shop notes:

It is difficult to give an intelligent reply to these questions as there are so many variants in the class of work, depending to a great extent on the percentage of yield as well as the relative weight of castings in the mold compared with the total weight.

The reduction of $1.00 per ton in pig iron may affect diversely the different malleable iron foundries, depending upon the percentage of pig iron used to the total scrap, but if all melted ferrous metals were reduced a dollar per ton, the reduction would be approximately $0.90 per ton, the difference being lost in oxidation. Should pig iron only be reduced that amount, the saving would be materially reduced, possibly down to $0.40 to $0.50, depending on the yield.

Associations Do Good Work

The splendid work which has been performed by trade associations in the different branches of the foundry industry is evidenced by the dependence placed upon them by their members. In responding to the first question the head of a gray iron foundry which is a member of the Gray Iron institute says:

I would probably first see that he was supplied with a copy of the "Standard Cost System" as published by the Gray Iron institute, not particularly with the idea that he would study it in all its details and thus get a clear picture of foundry costs, but with the thought in mind that if he realized after a casual inspection that we were following out a system that took into consideration even the most minute details, he would feel that a great deal of guess work had been eliminated from our costs, and that we were dealing with actual figures.

I would then show him a copy of the quarterly comparative cost report published by the institute showing comparative costs, and I believe that I could convince him that a variation of $1.00 per ton in pig iron could not be expected to change the selling price of castings more than approximately 5 cents per 100 pounds.

Different conditions are encountered in the steel castings branch as is evident from the following:

Where he uses the example of $1.00 per ton in increase or decrease in cost of pig iron I will use $1.00

per ton in decrease or increase of the average purchase price per ton of purchased scrap. On a 60 per cent yield the cost per ton of salable castings would increase about $1.30 per ton.

Quite evidently the influence of coke variations in price is even less important than the price of metal. A western gray iron foundryman says:

For your information I will say that coke usually costs from 12 to 14 cents per hundred pounds of good castings, and on a basis of 14 cents, a dollar a ton difference in the cost of the coke would make less than a cent a hundred pounds difference in the cost of the finished casting.

A malleable iron foundryman states that for each dollar reduction in the price of coke, the cost of castings is reduced $0.000565. Another states:

In the average malleable foundry it requires approximately 1 ton of coal to melt 2½ tons of iron. A reduction of one dollar per ton in coal would result in a saving of $0.40 per ton of metal charged, and in the castings would depend entirely on the yield.

Determination Is Difficult

The day to day variations in coke to iron ratio in melting for gray iron castings makes any general determination relative to this factor difficult if not impossible. One foundryman runs two cupolas on different kinds of iron and while the coke ratio for the entire plant might be reduced by running one cupola alone this is not deemed practical by the management. Similarly another foundry notes that with a coke ratio of 4 to 1 which is higher than most foundrymen are willing to admit, the effect of a $1.00 per ton variation in coke price would be negligible.

The human equation enters so largely into a consideration of the third question that it would seem almost impossible of a general determination. Of course, many foundries keeping individual costs over a period of years and with a steady production of a definite type of work, might attempt some statement in response to the buyer's fourth question. For example one foundryman answers:

On molder's wages, it seems to me that if you figured an average wage of $7.00 per day, and $1.00 reduction, this would effect our average molding cost on the entire foundry, about 8½ cents a hundred pounds.

Regarding the number of pounds per day, put up by the average molder, will say that we have a very complete record of each customer, and know exactly how many pounds per day we can get from any one customer's patterns. In addition to this, we have most of our patterns divided into classes and so we are able to pick out any one particular line of work and determine what production per day we can expect. We consider this confidential information,—not to be discussed with a customer.

Ten years ago, we did discuss this figure with a customer, and used the figure as a necessity for increasing the customer's price. This customer had formerly operated a foundry and he was of the opinion that our figure was a very low production and the final result was that we lost his account, and from this on, we have made it a rule never to discuss what we call price per molder per day.

Unless the nature of the work is known, one malleable foundryman points out that it is impossible to determine what the savings in cost per pound may be by a reduction of a dollar per day in molder's wages. Likewise, it is impossible to determine the approximate number of pounds a molder may be able to produce as that would depend entirely upon the design of the casting, type of pattern equipment and the volume of orders, from which the type of foundry equipment used to give the greatest amount of production would be determined. A second malleable company states that for each dollar per day reduction in molders wages, the reduction in price per pound of castings approximates $0.00158.

Basing a price fluctuation solely upon what is known as productive labor likewise is a fallacy. This is explained clearly in the answer submitted by a gray iron foundryman who says:

From the wording of this question, this man evidently thinks that molder's wages fluctuate and that the balance of wages in the shop do not make a great deal of difference. For his information, you might state that for every molder, we have two and one-half men on our pay roll, and in most foundries the molder's wages are the only part of the labor that is considered direct labor, the other charges, which are in most cases much more than the molding charge, are considered incidental, and this is the same opinion that this buyer has. If the molder's wages increase it can be assumed that wages throughout the entire shop would increase."

Another Factor Added

Furthermore the wide variation in production between exceedingly light work and medium or heavy castings brings another factor into this problem of the effect of slight changes in molder's wages. A gray iron foundryman operating several foundries calls attention to this factor as follows:

This, however, is only an average figure, and you readily appreciate that a little casting of which we make 100 in a mold, and 500,000 of them weigh about 250 pounds, and a day's work would weigh only 50 pounds and an increase in molder's wages of $1.00 per day, would add 2 cents per pound to this casting, whereas, on fly wheels, weighing 100 pounds, where one molder produces probably 3000 pounds per day, and an increase of $1.00 per day in the molder's wages would increase the cost only $0.00033 per pound.

Other commentators upon this same question deal with the various phases of proportion of good castings, changes in production, rate due to revising methods, installing new equipment, etc. The average weight of good castings produced per day varies in every foundry and in every department of the same. A steel foundryman in response to this question gives production figures indicating this wide spread of output on different classes of work. He tabulates the production per man per day in the various departments of a foundry which produces castings of an average weight of about 30 pounds. These figures are as follows:

	Pounds per man
Bench department, average of....	425
Squeezer department, average of	860
Floor department, average of....	850
Jolt department, average of.....	980
Special unit, average of.....	4000

Various groups of foundries interested in cost matters have been established. These groups turn in to some impartial agency or cost expert various items having interest to all of the members. These items are tabulated and keyed, and reports are compiled which are sent to the individual members of the groups. A comparison of these general reports with each members own figures gives a valuable aid in governing costs.

Production Discussed

The question of production is one of the items commonly discussed. One such group gives an average production on light work of 550 pounds per day; in heavy foundries 1080 pounds per day. Some foundries in the light classification are as low as 400 pounds and some as high as 700 pounds per day. The fallacy of attempting any generalization upon this factor of production per day is shown by a gray iron foundryman who takes specific examples:

Let me refer you to a valve guide casting which is very small, weighing let us say 0.35 pound, but on which we get many per mold because of its compact design and is a very inexpensive casting to make. Now let us compare that with a 6 pound automotive water pump casting. The comparison in the average production per day in pounds is evident, all of this only confirms my conception of selling prices, which are seriously misunderstood when quoting by the pound. Let me further illustrate, suppose we made a casting ½ inch thick, 8 inches in diameter, one in a mold, weighing approximately 6 pounds, now let us make that casting 1-inch thick, we have doubled the weight without increasing the cost of production one bit, except for the cost of the actual material. We will use the same size flask, the production per day will be exactly the same, the cleaning cost will be exactly the same, the only possible variable will be the cost of material, and how much more logical it would be to say that the first casting will cost $0.30 and the second casting $0.42 for example, because we have

only added 6 pounds of material at an average cost of, let us say $0.02 per pound, instead of saying that the first casting will cost $0.05 per pound and the second casting $0.035 per pound. The first set of figures shows an increase in price consistent with the additional material the buyer receives. The second set of figures sets up a very mistaken opinion in the mind of the buyer that he has received a reduction in price.

A malleable foundrymen answers the question by saying:

In making light castings, a molder will produce from 500 to 700 a day. Medium castings made with machine equipment will approximate 2500 pounds per day.

This variation in output per man exercises an adverse as well as a favorable effect on costs as is pointed out by a gray iron foundry making medium and heavy work. This foundry says that if production per molder increases the labor cost goes down but usually the molder begins to use more floor space and equipment so that the overhead charge directly affecting each job is increased. The final effect upon costs is not determinable except by specific information upon each individual job.

The final point in this inquiry concerns the question of yield. This is a control factor directly influenced by the ability and ingenuity of proper management. All such figures are relative, one foundryman mentions, in the firm where a foundry is operated as a department of a manufacturing establishment. Naturally this foundry has been running the same patterns for many years, they have made improvements and innovations in rigging and methods. They have cut their costs more closely than would be possible for any jobbing foundry faced by the necessity of handling a variety of work. After all the yield is a relative matter.

Yield Is Studied

Some foundries make a study of average yield running consistently over long periods. A steel foundry responds to this fifth question by saying:

Our average yield over a period of a year is about 60 per cent; that is, to every ton of charge melted in the electric furnace we get about 1200 pounds of good castings, and the balance is made up of heads and gates, spills and skulls, defective, other metal accounted for, melting loss, and unaccounted for, the total being 100 per cent.

The consideration of sprues, gates, risers, etc., which enters into the whole question is emphasized by a gray iron foundry in answer to the fifth question who says:

What your question means by saying this, of course, will take into consideration the sprues, gates and risers, etc., as well as the normal scrap is difficult to determine. Our yield varies from 53 per cent to about 65 per cent. We have a three pound casting, with 4 per mold and about 2 pounds of gates and risers and an average yield of 70 per cent, and then again a small nut where we have about one-half pound of casting and about 4 pounds of gates and riser, for a yield of about 10 per cent.

The yield depends upon the sprue and risers required to feed the castings, and would probably vary all the way from 30 to 70 per cent, according to a malleable foundryman. In some cases, it is pointed out, the yield on large castings may be even greater. Another producer of the same class of castings answers the fifth questions by giving a yield of approximately 950 to 1000 pounds of good castings per ton of iron melted.

These discussions no doubt will prove illuminating to the inquirer. Further they should be of value to other foundrymen in pointing to factors that are likely to confront them under present business conditions. A complete discussion of the first three questions contributed by a steel foundryman seems worthy of presentation as a unit. Accordingly this will be given in a future issue.

Chicago Founders Hear Steel Executive

Steel founding is fast becoming an exact science, and another 10 years probably will see nearly all steel foundry procedure closely calculated and controlled, according to Frederick A. Melmoth, assistant manager, Detroit Steel Casting Co., Detroit, in an address before the Chicago Foundrymen's club Thursday evening, March 5. Mr. Melmoth, who gave the 1928 exchange paper of the Institute of British Foundrymen before the American Foundrymen's association convention, declared that fast-moving developments and researches in all industrial groups make it imperative that the foundry industry maintain the same pace. He emphasized design, melting, mold and core work, and the after-treatment of the castings as the chief subjects for logical study and application of scientific control.

Asserting that the industry has more designers of parts and sections than it has designers of castings, the speaker suggested the development of castings designers for engineering staffs. According to the speaker, the designer has within his grasp 60 per cent of the success of the casting. Science in the foundry, he said, should be regarded essentially as the predetermination and thinking out of all methods.

Mr. Melmoth stated that science already is at the bottom of many of the melting problems relating to physical operations as well as chemical analysis. He illustrated the statement that chemical considerations are not final by pointing out that the final silicon content of the steel often results from pre-existent oxides. Faulty physical operations have resulted in cracking irrespective of chemical analysis. He praised the work being accomplished in the study of nonmetallic inclusions. Mr. Melmoth noted possibilities of much greater control in mold and core making, which he termed the heart of steel castings production.

S. T. Johnston, S. Obermayer Co., Chicago, past president of the American Foundrymen's association, also gave a brief talk.

Foundrymen Hear Talk on High Test Iron

Fifty-six members of the New England Foundrymen's association attended the regular monthly meeting of that group on March 11 at the Engineers club, Boston. Luther J. Anthony, president of the association, presided at the meeting. R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, was appointed chairman of a committee on transportation in connection with the American Foundrymen's association convention to be held in Chicago, May 4-7. The next regular meeting will be held in Worcester, Mass.

Due to sickness, Oliver Smalley, technical director, Gray Iron institute, Cleveland, the scheduled speaker, was unable to attend. However, a program was arranged by LeRoy M. Sherwin, vice president of the society, which proved exceedingly interesting and promoted a lively discussion. Thomas F. Kiley, Brown & Sharpe Mfg. Co., Providence, R. I., presented an interesting paper on "High Test Cast Iron" supplemented with illustrations. Walter M. Saunders, Providence, R. I., also spoke on "Notes from My Notebook of Experiences."

Connecticut Nonferrous Foundrymen Meet

The regular monthly meeting of the Connecticut Nonferrous Foundrymen's association was held March 9 at the Hotel Garde, New Haven, Conn., with C. H. Blanchard presiding. C. E. Billings and D. S. Sammis, New Haven Sandblast Co., New Haven, Conn., gave interesting talks accompanied by illustrative material on sandblasting problems in nonferrous foundries. Following the talks, the speakers answered questions presented by members.

Next meeting of the organization will be held at the same place with Dave Tamor, metallurgist, Pratt & Cady division, Reading Steel Casting Co., Hartford, Conn., as the speaker. Mr. Tamor will lead a round table discussion on general foundry problems.

Interest Accelerates As Chicago A. F. A. Show Nears

Many Manufacturers Request Space for Exhibition in Stevens Hotel—Technical Program Excels

PLANS for the exhibition and the technical program of the thirty-fifth annual convention of the American Foundrymen's association, to be held in the Stevens hotel, Chicago, May 4 to 7, promise much of value to the foundry industry. A great amount of interest has been evidenced by a large number of exhibitors requesting space for the show. In excess of 130 reservations have been ordered and additional applications are being received at the A. F. A. office daily. A wide variety of exhibits will be shown, including the latest and most interesting developments in foundry equipment.

Convenience Is Assured

The facilities of the Stevens hotel, where all the activities will be scheduled, provide an especially convenient arrangement of exhibit space and registration and meeting rooms. The exhibit accommodations will include both Exhibition hall and the grand ballroom, giving considerably larger exhibition facilities than were available at the 1929 meeting, when only exhibition hall was used. The grand ballroom will be the center of activities, being immediately adjacent to the registration and general headquarters, which will be located in the ballroom foyer, with the meeting rooms on the floor above.

An exceptionally large number of worth-while papers have been submitted this year, for presentation during annual Foundrymen's Week. The opportunity thus afforded of selecting only the best of material for the convention has permitted arrangement of an excellent program —one which it is believed will offer much of value to the foundry industry.

These papers cover a wide range of subjects, dealing with every major phase of metal founding. In general, however, the results described exemplify a decided trend toward greater effort in placing the production of castings on a higher plane of control, thus permitting castings to be produced with better physical properties and reducing the percentage of defects.

A considerable part of the four-days' program will be devoted to the discussion of problems relating to specific types of cast metals—gray iron, malleable iron, steel and nonferrous castings. At the same time, several sessions of general interest also have been provided. In the general interest group, talks and papers of interest to all foundrymen will be presented at sessions on sand control, pattern production, costs and apprentice training.

Nonferrous Program Extended

A nonferrous program, the most ambitions and extensive ever attempted at an A. F. A. convention, will be a noteworthy feature this year. This will include a shop-operation course of three distinct sessions devoted to gating problems, a round-table discussion group, a session on nonferrous cost methods, and two sessions on plant and metallurgical methods.

Several sessions of varied interest have been provided for steel founders in attendance at the convention. In addition to a three-session, shop-operation course, a round-table dis-

The Ball Room, Shown at the Right, and the Exhibition Hall of the Stevens Will Be Used For the Show

Lower Illustrations Show the Exhibition Hall as it Appeared During the Chicago Meeting of the A. F. A. in 1929

cussion group and two sessions on technical subjects will be held.

In the malleable iron division, the initial shop-operation course is being organized under the direction of a committee consisting of A. M. Fulton, Northern Malleable Iron Co., St. Paul, A. Van Lantschoot, Iowa Malleable Iron Co., Fairfield, Iowa and W. L. Ranis, Union Malleable Iron Co., Moline, Ill. In addition to this practical course, there will be a round-table luncheon meeting and a session on metallurgical phases of malleable production.

An exceptional program has been prepared by the gray iron program committee. This will consist of a shop-operation course on gating, heat treatment and high-test cast irons, and three sessions at which papers on metallurgical and plant operation problems will be presented.

A partial list of papers which are scheduled for presentation and discussion at various convention sessions are as follows:

STEEL CASTINGS

"Chemical Composition as Employed for Classifying Carbon and Alloy Steels for Casting," by Maj. R. A. Bull, Electric Steel Founders' Research group, Chicago, "Some Metallurgical Points on Acid Open-Hearth and Electric Steel for Castings," by F. A. Melmoth, Detroit Steel Casting Co., Detroit, "Centrifugal Casting of Guns," by Col T. C. Dickson, Watertown Arsenal, Watertown, Mass., "A Comparison of Synthetic and Natural-Bonded Molding Sands for Steel Foundries," by H. J. Cole, General Electric Co., Schenectady, N. Y., "Interrelationship of Pin-Hole Trouble and Low Ductility Problems," by George Batty, Steel Castings Development bureau, Philadelphia.

MALLEABLE IRON

"Thermal Balances of Malleable Melting Furnaces and Production Costs," by J. H. Hruska, Berwyn, Ill., "High Tensile Materials," by Dr. Anson Hayes, American Rolling Mill Co., Youngstown, O., "Report on Malleable Furnace Refractories," by J. R. Allan, International Harvester Co., Chicago.

FOUNDRY COSTS

"Weak Points in Cost Systems Which Permit Leakages," by E. A. Baker, Ellery A. Baker & Co., New York, Report of Committee on Required Estimating Data, Report of Committee on Methods for Estimating Molding Costs.

APPRENTICE TRAINING

"Getting a Community Apprenticeship Program Under Way," by H. S. Falk, Falk Corp., Milwaukee, "Related Instruction," by S. M. Brah, Tri-City Manufacturers' association, Moline, Ill.

SAND RESEARCH AND CONTROL

"Effect of Heat on the Permeability of Facing and Core Sands," by W. M. Saunders, Providence, R. I., "Shape of Sand Grains," by Dr. H. Ries and G. D. Conant, Cornell university, Ithaca, N. Y., "Some Observations on the Use of Synthetic Sands," by L. B. Knight, National Engineering Co., Chicago, "Relation Between Sand Grains and Strength of Sands," by Dr. H. Ries and H. V. Lee, Cornell university, Ithaca, N. Y.

NONFERROUS FOUNDRY PRACTICE

"Deep Etching of Brass as Applied to Gating Problems," by R. W. Parsons, Ohio Brass Co., Mansfield, O., "Cupola Melting of Brass," by T. Mauland, International Harvester Co., Chicago, "Permanent-Mold Foundry Practice for Brass and Bronze Castings," by Henri Marius, Lenoir Car Works, Lenoir City, Tenn., "Molding Practice for Heat-Treated Aluminum-Alloy Castings," by L. H. Fawcett, U. S. Naval Gun Factory, Washington, "The X-Ray as a Tool for Improving Aluminum-Alloy Foundry Practice," by H. J. Rowe and E. M. Gingerich, Aluminum Co. of America, Cleveland, "Bronze Pressure Castings," by J. E. Crown, U. S. Naval Gun Factory, Washington.

GRAY IRON

"An Inclusion in Cast Iron and its Relation to Manganese and Silicon Content," by F. J. Cook, Birmingham, England, "The Microscope as a Tool in Investigating Cast Iron," by R. M. Allen, Bloomfield, N. J., "Gating," by Max Kuniansky, Lynchburg Foundry Co., Radford, Va., "A Contribution to the Study of the Part Played by Phosphorus in Cast Iron," by J. Dessent and M. Kagan, Liege, Belgium. (Exchange paper of the Belgian Foundry Technical association,). "Factors Which Influence the Surface Quality of Gray Iron Castings," by W. G. Reichert and D. Woolley, Singer Mfg. Co., Elizabethport, N. J., "Effect of Atmospheric Moisture on Cupola Operation," by N. A. Moore, Piston Ring Co., Muskegon, Mich., "Electric-Process Iron for Cylinder and Cylinder-Head Castings," by H. E. Bromer, Standard Foundry Co., Racine, Wis., "Melting Gray Iron and Malleable Iron in the Indirect-Arc Furnace," by J. H. Vogel and J. C. Bennett, York Ice Machinery Co., York, Pa., "Testing Cast Iron," by Major Nicalau, Paris, France. (Exchange paper of French Foundry Technical association.), "Manufacture and Use of Cupola High-Test and Alloy Irons in Machine Tool and Jobbing Foundry," by L. M. Sherwin and T. F. Kiley, Brown & Sharpe Mfg. Co., Providence, R. I.

Tentative Program

Monday, May 4

9:00 A.M. Registration Starts.
12:00 Noon Exhibition Opens.
10:00 A.M. Committee Meetings.
1:30 P.M. Committee Meetings.
3:00 P.M. Opening Meeting.
4:00 P.M. Committee Meetings.
4:30 P.M. Shop Operation — Sand Control.

Tuesday, May 5

9:00 A.M. Shop Operation — Sand Control.
10:00 A.M. Gray Iron — High Test and Alloy Cast Iron.
Malleable — Metals and Melting.
Nonferrous—Foundry Costs.
Pattern Production.
12:15 P.M. Malleable Luncheon and Round-Table.
2:00 P.M. Foundry Costs.
Sand Research.
4:00 P.M. Shop Operation Courses.
(a) Steel.
(b) Gray Iron.
(c) Malleable.
(d) Nonferrous.
7:00 P.M. Annual Dinner of Instructors of Engineering Schools.

Wednesday, May 6

9:00 A.M. Shop Operation — Sand Control.
10:00 A.M. Gray Iron — Melting Methods.
Nonferrous — Plant Methods.
Steel Founding — Metallurgy.
12:15 P.M. Steel Luncheon and Round Table.
Nonferrous Luncheon and Round Table.
2:00 P.M. Apprentice Training.
4:00 P.M. Shop Operation Courses.
(a) Steel.
(b) Gray Iron.
(c) Malleable.
(d) Nonferrous.
7:00 P.M. Banquet.

Thursday, May 7

9:00 A.M. Shop Operation — Sand Control.
10:00 A.M. Gray Iron—General Practice.
Nonferrous — Plant Practice.
Steel—Plant Practice.
2:00 P.M. Business Meeting.
4:00 P.M. Shop Operation Courses.
(a) Steel.
(b) Gray Iron.
(c) Malleable.
(d) Nonferrous.

Sand Company Opens Field Laboratories

Whitehead Bros. Co., 537-539 West Twenty-seventh street, New York, recently opened two field laboratories for sand testing, one in Albany, N. Y. and the other in Dorchester, N. J. The laboratories contain modern equipment and will be used to test sands that the Whitehead company produces. In addition, that company will test sands for foundrymen and will give reports based on American Foundrymen's association specifications. The laboratories have been installed to aid in checking uniformity of product.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

SHRINK bobs are associated more closely with malleable iron than with any other form of castings, but occasionally the idea is adapted to some extent and applied to gray iron castings. A typical application of a shrink bob in a malleable iron ball mold is shown in the sectional view, Fig. 32, where the sprue *A* delivers the metal into the greatly enlarged runner *B*. In this instance *B* is the shrink bob and supplies metal through the gates *CC*, first to fill the mold cavities *D* and *D*, and later to feed the castings when they begin to shrink in solidifying.

Although the term malleable iron ball mold is used in the preceding paragraph, it does not necessarily imply that the castings are malleable iron. In many malleable foundries these ball castings are poured from the regular malleable iron mixture, but the castings afterward are not subjected to the annealing process. They are shipped in the hard, or white iron stage. Similarly where these castings are made in a gray iron foundry, the metal is melted in a cupola from an iron or scrap steel mixture that will yield a white fracture. This variety of iron shrinks more than any other, hence the necessity of providing an auxiliary supply in a riser or shrink bob to feed the casting as it shrinks.

The bulk of these castings are poured in iron or so-called chill molds where the gating problem is reduced to the simple necessity of providing a passage for the distribution of the metal. The outside of the casting solidifies almost immediately. Therefore no further metal can be drawn in from the gate.

Half a typical, ball mold is shown in Fig. 33. This half is anchored solidly to a suitable foundation. The other half is movable. It is mounted on slides and actuated by a hydraulic or pneumatic piston rod. The mold is closed by advancing the movable half until the opposing faces of the mold come into contact. After the mold has been filled with molten iron and after the iron has solidified, the movable half of the mold is drawn back and the castings fall into a suitable receptacle, or, on to a conveyor which takes them to the shipping department. Usually these molds are set up in batteries to permit continuous pouring. The number of molds and their arrangement depend on the melting capacity of the cupola, the size of the balls, the number of men employed and other factors including that which probably should be listed first, the volume of orders to be filled.

The term shrink bob is another one of these foundry expressions apparently coined on the spur of the moment and then adopted universally, not because of its accuracy, but because it has a pleasing sound and supplies a specific name for something formerly referred to in a round about manner.

If one is minded to analyze the term he will find it misleading. In its present form the term might be translated to mean a device for the promotion of shrinkage. Every foundryman knows that its function is just the opposite, to prevent shrinkage in the casting to which it is attached. Even that statement is not sufficiently accurate. The shrink bob does not prevent shrinkage.

Cite Old Masters

SLIP shod methods, heartily condemned by the foundry writers of the eighties and nineties, still prevail in some places. Reluctance to making castings in comparatively inexpensive open sand molds is due to the fact that only a relatively small number of men are qualified by training or experience to form molds of this kind. A 6-month's course in open sand molding would teach an apprentice more about the behavior of metal in a mold, than 6 years' attempt to gain information from examination of castings poured in closed molds. Care and skill in pouring the metal are as essential as they are in making the mold.

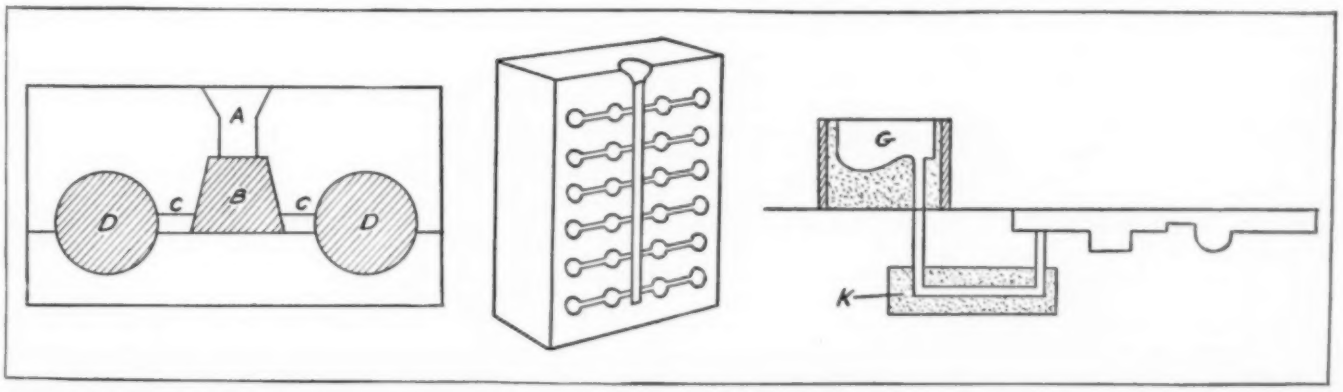


Fig. 32 (Left)—Illustrating Use of Shrinkbob. Fig. 33 (Center)—Arrangement of Gates and Runner in Permanent Mold. Fig. 34 (Right)—Use of Bottom Gate Core on Open Sand Mold

Shrinkage is a natural law and cannot be frustrated. The purpose of a shrink bob is to supply metal to the casting to compensate for the loss in volume through natural shrinkage.

Use of the word *bob* in the combination probably is due to our wide spread use of the word as a term of abbrevation. Thus we have bobbed hair, bob sleds, bob tailed nags and bob tailed flushes. Cats from the Isle of Man and wild cats are without tails and are known as bob cats. The happy inspiration to call the device under discussion, a shrink bob, probably arose from its resemblance to a short or bob tailed riser, that is a riser, feeder or sink head which did not extend all the way upward through the sand of the cope.

This merely represents the personal opinion of the writer and is not supported by either spoken or documentary evidence. He will be glad to hear from any one who has a more plausible theory. Manifestly only a theory is possible, since no possibility exists of checking up on the original coiner of the term. Also it is pertinent to point out here that the foundry industry is notorious for its lack of literature up to the closing years of the nineteenth century.

Single Gates Favored

In the eighties and nineties, Robert E. Masters, the late Thomas D. West, Simpson Bolland, and a few others contributed articles to the technical press. However, in describing a material, a method or a piece of equipment, they employed the shop terms and the shop form of expression. They gave freely of their time and talents in disemminating information acquired through personal investigation.

On many castings, the shape, size, position and number of gates are not factors of importance. Any opening at any point through which metal may be spilled into the mold, will serve. In other instances each or all these are factors of major importance and exert a direct bearing on the condition of the resulting casting.

Wherever possible, a single gate of minimum cross sectional area is preferable to any other style, if for no other reason than the saving in metal involved and the saving in time in the cleaning department where the stump must be chipped or ground in the event that the iron in the gate did not break away clean from the casting.

This is a feature which perhaps might have been stressed a little more in the reference to set gates appearing in a previous installment of this series. Where the pattern for the set gate is designed properly, smallest at the point where it touches the pattern for the casting, the iron in the gate will break away clean. In many instances no chipping or grinding is necessary.

Many of the factors which limit the use of the single gate on certain castings, do not apply on castings that are poured in open sand molds. Where a plate poured under a cope may require a row of branch gates along one or both sides or ends, the same plate may be cast in an open sand mold from a single gate. The gates on a coped mold are limited by the thickness of the casting. The stream of metal entering an open sand mold, may be increased or decreased at the will of the man operating the ladle. Irons of various compositions and temperatures do not run with equal facility. Many a good casting has been lost or saved by the manner in which the metal was poured into the mold.

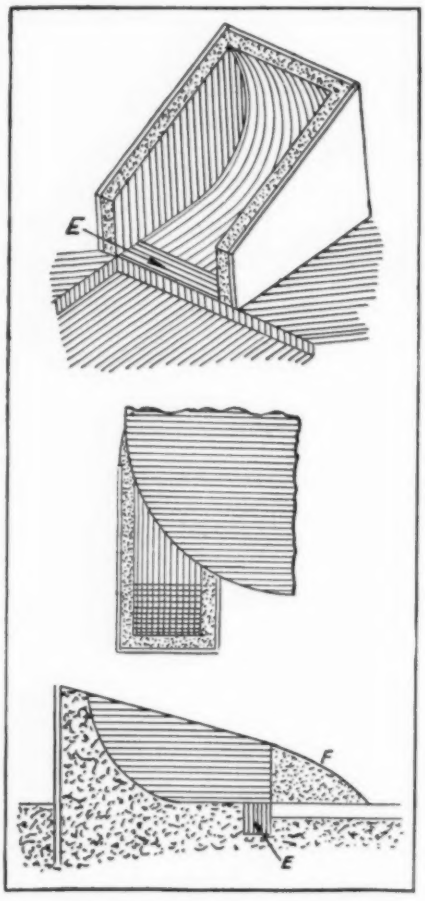


Fig. 35 (Above)—Runner Basin for Open Sand Plate. Fig. 36 (Center)—Runner on Round Plate. Fig. 37 (Below)—Dry Sand Core Protects the Edge of the Runner Basin

In the early blast furnace days all the gray iron castings were formed in open sand molds. An impression of the desired article was made in the sand of the pig bed which extended in front of the furnace. When the iron was tapped, it flowed into the long sow (a central channel) and thence into the rows of shorter transverse channels at each side, known as the pigs. The casting or castings were filled at the same time and in the same manner as the pigs. This probably is the first exemplification of the single gate, the narrow passage between the sow and each pig or casting.

Many castings still are made in open sand molds, but not nearly as many as might be made profitably if sufficient attention was paid the subject. In the *Iron Founder Supplement, a Complete Illustrated Exposition of the Art of Casting in Iron*, published by John Wiley & Sons in New York in the year 1893, the author, the late Simpson Bolland, covers this subject in considerable detail. Whether the present generation is behind, or, Mr. Bolland was ahead of his time, the fact remains that his chapter on gating leaves little room for improvement. He had a comprehensive knowledge of the principles involved and many years' experience in the practical application of these principles. Slightly abridged, his observations and instructions for gating open sand castings properly are set forth in the following:

Open sand castings are not nearly as numerous as formerly. This is not because of any particular fault inherent to the system, but rather that so few men are competent to make the castings successfully. Many molds are covered at an augmented cost, which might have been saved to the founder or his customer, had the needed help for the production of these castings been on hand. Pouring constitutes the chief trouble with open sand work. When this is understood thoroughly, good castings can be produced in open sand molds.

Pour Open Sand Mold

The usual practice is to cut channels at intervals round the edge of the mold to regulate the thickness of the metal in the casting. The flow of metal is supposed to be checked when the thickness is reached. This kind of practice is unreliable. Usually on large plates, more than one ladle is used for pouring.

The feeling of uncertainty which exists, prevents unity of action. The plate almost invariably is imperfect, if not a total loss. It is either too thick or too thin, or perhaps thick and thin at various points.

The logical method is to take the correct amount of metal in the ladle and pour it into the mold where the sides are higher than the thickness of the casting. A runner basin at one corner of a 7 x 7-foot plate convenient for quick handling of the metal is shown in Fig. 35. It is formed after the manner shown to permit a stream 2 feet wide, with a gradual curving surface from the back to the front. To prevent the rushing iron from washing away the green sand edge, this part of the mold is formed with the dry sand core shown at *E*.

The correct amount of iron in the

ladle is poured briskly down the incline of the runner basin. The wide stream will strike the opposite corner of the mold with sufficient force to drive it at right angles to the next corner, and so on. Urged by the constant stream behind, the metal whirls uninterruptedly around the periphery, and finally settles itself evenly all over the mold.

Plan and elevation of the same type pouring basin on a round plate are shown in Figs. 36 and 37. This runner is set tangential to the circle, to strike the edge, made up high as shown at *F*. This causes a rapid rotation of the molten mass, which ultimately settles or rests evenly and results in a plate of uniform and anticipated thickness.

Where a casting in open sand presents some difficulty on account of ribs, hubs, lugs, brackets, pockets or other irregularities on the under or face side, advantage may be taken of the gating method shown in Fig. 34. By placing one or more of these gates at such parts as will provide for a steady flow of iron into the mold, the greatest nicety of control may be exercised. Any degree of pressure may be secured by increasing or diminishing the height of the runner basin *G*. The runner, that is the lower channel in this gating system, can be formed in a dry sand core as shown at *K*.

Change Pouring Speed

Objection may be raised by present day foundrymen that it is not always practical to take just the correct amount of iron in a ladle to pour an open sand casting. In the ordinary jobbing shop the practice is to fill the ladle under the spout and then pour several castings. An experienced man can estimate closely the amount of iron left in a ladle after each mold is poured, but this is a form of knowledge that only may be acquired through actual experience. Also before pouring the second, third or fourth mold from the same ladle, the operator wants to feel assured that he has a little more than the required amount in the event of contingencies. Molds have been known to run out at the most inopportune times. Castings sometimes swell. The lining in a ladle is not necessarily uniform from day to day, thereby affecting the volume of metal.

Under the usual shop conditions, where several molds are poured in succession from the same ladle, and where ⅛-inch variation in casting thickness is not considered serious, open sand castings may be poured satisfactorily by intelligent manipulation of the ladle. The bottom of the pouring basin is filled gently and then the ladle is tipped rapidly to drive a stream to the opposite side of the mold. If this was continued, the molten metal would rise at that point and climb over the edge. This is prevented by restricting the stream of iron from the ladle until the first flood has struck the far away barrier and has started to return. The ladle again is tipped rapidly and the result is that the opposing streams meet and neutralize each others speed. A steady stream from the ladle then can be maintained until the iron in the mold has risen to the desired height.

Local conditions and the relative importance of the casting, decide whether the walls of the mold are made the exact height of the casting thickness, or, built from ½ to 1-inch higher with flowoffs at two or more points to indicate when the desired thickness of metal has been reached.

In either case, cognizance must be taken of the fact that on account of what is known as surface tension, the metal will rise ⅛ and in extreme cases ¼-inch higher than the confining wall of the mold before it will commence to run over. The height to which metal will rise in this manner depends on the temperature, or more properly speaking, the fluidity. Some irons are more fluid at a given temperature than others.

The intense heat in the vicinity of a large open sand casting is a factor which must be taken into consideration. No man can exercise proper control over a ladle while the skin on his hands, arms and face is scorching. In many instances this feature is entirely over looked until the last moment and then the greatest confusion arises in attempt to supply emergency protection.

Definite preparation should be made in advance by the erection of a suitable screen behind which the operator can watch the behaviour of the metal in the mold and thus be in a position to regulate the size of the stream falling from his ladle. On comparatively small jobs, a bottom board, preferably dampened with water, will serve. On large jobs, corrugated steel sheets, or other form of easily handled steel sheets may be employed.

Weight Is Calculated

For the benefit of beginners and perhaps others who up to the present have not familiarized themselves with the subject, and who may want to adopt the method advocated of taking the correct amount of metal in a ladle to pour an open sand casting, the following rules are presented for calculating: 1—The weight of the casting, and, 2—The weight of iron in the ladle.

The weight of the casting is found by multiplying the cubical contents in inches by the constant 0.26. The result will represent the weight in pounds. Thus a plate 30 x 60 inches and 1½ inches thick will weigh 30 x 60 x 1½ x 0.26=702 pounds.

Sometimes it is more convenient to reckon the area in square feet, based on the knowledge that the weight of a cast iron plate 1 foot square and 1 inch thick is 37.5 pounds. The figures for the foregoing plate then are set down 2½ x 5 x 1½ x 37.5=703 pounds.

The weight of a circular plate is found by squaring the diameter in inches and multiplying by the constant 0.206. The result is the weight of a plate 1 inch thick. Thus a plate 60 inches in diameter and 1 inch thick will weigh 60 x 60 x 0.206=741 pounds. For a plate 2 inches thick the weight is doubled and so on.

This rule, as previously explained, also may be applied to finding the capacity of a ladle, or for deciding the quantity of metal required in a ladle to pour any given casting.

Assuming that the problem is to tap 702 pounds of iron into a ladle 20 inches in diameter. A plate of iron 20 inches diameter and 1 inch thick weighs 82.40 pounds. Manifestly if 702 is divided by 82.40 the answer will be the height of the body of iron in the ladle in inches, in this instance 8½ inches. A mark is placed on the lining 8½ inches from the bottom and the iron is allowed to flow into the ladle until it reaches this mark.

This is the seventh of a series of articles dealing with the various types of gates and risers used in the foundry industry. The eighth instalment will appear in an early issue.—THE EDITORS.

Molding Large Castings

(*Concluded from Page* 51)

placed on the drag again. After the cope is rammed it is lifted off, and finished. The pattern is withdrawn from the drag, and it is finished. When the molds are finished the several parts forming the core are brought in and assembled on the floor near the mold. The molds are blacked with plumbago and skin dried. Then the parts of the core are placed in the mold, which then is closed. The mold is clamped, the runner basin made and put over the sprue openings, and the cavity is filled with molten metal. Two sprues with gates cut into top and bottom rims of the castings supply metal to the cavity while two risers on the central opening form additional metal reservoirs.

In addition to the castings described the Hodgson Foundry Co. makes a variety of all copper castings. These include blast furnace tuyeres, coolers, bosh plates, etc. Metal for the various types of castings is melted in tilting type, coke-fired, crucible furnaces. Forced draft supplied by a soft-blast fan supplies the air for combustion. Each furnace contains a crucible with a capacity of 600 pounds. The crucibles are made with lips which project through the furnace walls. Metal from the furnace crucibles is poured into smaller ladles which are used for filling the various molds.

What Is Wrong with Steel Casting Sales?

Steel Founder's Society Questions Buyers, Sales Managers and Executives on Troubles and Their Cure

FOR many years casting producers commonly have understood that the majority of casting buyers purchased their requirements solely on a price basis. However, that idea apparently has been exploded according to data obtained from questionnaires sent to steel castings buyers by Granville P. Rogers, managing director, Steel Founders' Society of America Inc., New York. Several hundred inquiries were sent out, and of those returned, 100 were selected at random to ascertain the general trend of thought of castings buyers regarding the purchasing of steel castings. In addition to those questionnaires, others were sent to member foundries to obtain suggestions on methods to improve steel casting sales.

Considerations Are Listed

According to data obtained from 100 buyers of steel castings, only 6 per cent hold price as their first consideration. Seventy-two per cent said that quality came first, and the various factors relating to quality were listed in the following order: Soundness, machinability, appearance, trueness to pattern, strength, and durability. Service and reliability was given by 12 per cent as their criterion in purchasing steel castings, and various component factors entering in were weighted as follows: Dependable source of supply, financial condition, co-operation, business ethics, courtesy, and desire to satisfy. Ten per cent of the inquiries said that location and delivery were the important factors in their purchases of steel castings.

Much depends upon the steel casting salesman as he is the contact or link between the buyer and the foundry. Consequently, he must exert every effort to leave a lasting, favorable impression on those with whom he comes in contact. Data obtained from the questionnaires pertinently point out that the steel casting salesman must be more than just another salesman, as will be shown later. In the first analysis the reports show than 83 per cent of those replying place steel casting salesmen on a par with salesmen of other products. Fifteen per cent stated that they are above the average, and only 2 per cent believe the steel casting salesmen below the average.

While many salesmen and executives of steel foundries may be satisfied with the rating of being on a par with salesmen of other products, some of that satisfaction may be evaporated speedily when it is mentioned that 38 per cent of the replies state that the steel casting salesmen lack technical, foundry, and engineering knowledge. Twenty-five per cent believe that unethical sales practices, breaking of promises, and disregard of truth are practiced by steel castings salesmen. Weak sales methods and policies are attributed by 23 per cent as being faults in the present methods of selling steel castings, and 14 per cent complain about the lack of co-operation and service.

The previous summary is broken down into the following factors in the order presented. Lack of technical knowledge on the part of steel salesmen is placed at the head of the list of faults in the present methods of selling steel castings. Second, salesmen lack knowledge of the product from the customer's point of view, and third, salesmen are not familiar with foundry methods and how castings are made. Complaint is made that salesmen do not work closely enough with the customer, and there is a lack of close contact between buyer and sellers.

Fall Down on Deliveries

Castings buyers stress the fact that salesmen often make low quotations on the first order to obtain business. Another objectionable feature is that the sellers fall down on promises and delivery dates, especially after the first order. The practice of underestimating the ability and service of competitors, and knocking competitors is censured. Needless delay is caused by salesmen who are unable to quote prices without consulting the home office, and others take up too much of the buyer's time.

Apparently, castings buyers are looking for information on steel castings, as, it is pointed out, one of the faults of present selling methods is the fact that salesmen do not present facts about steel castings regularly and often enough. Another is that too many salesmen are after a small volume of business. Many buyers object to the fact that quotations are based on schedule instead of by the piece or unit. The final item in the list of faults is that salesmen fail to stress quality of product.

Technical Knowledge Required

Suggestions for the improvement of selling methods offered by the 100 selected replies to a large extent advance ideas to correct the faults previously enumerated. As may be expected, the first on the list is that salesmen should acquire more technical knowledge of the steel castings business. This is followed by the suggestion that salesmen maintain closer contact with and co-operate more with the customer, acquiring knowledge of the product from the customer's viewpoint. A third point is that salesmen should familiarize themselves with modern foundry methods. Those suggestions are quite logical, and their value is evident, for, if the salesman has the technical and practical knowledge, and can talk the product from the user's point of view, there is bound to be a closer contact between the buyer and seller of steel castings.

Foundries should educate their salesmen, and clothe them with the necessary authority to quote without having to refer to the home office for an O.K. Salesmen should call upon customers more frequently and keep them informed on modern steel castings and steel foundry practice. They should not knock their competitors, and much less, fail to give due credit to them. Time is important in the business world, and the salesman should take up the minimum quantity of the buyer's time. It is pointed out that honest information on delivery dates and care of patterns should be given, and that quotations should be by the piece, and not by schedule or by the pound.

It is suggested that steel found-

ries develop price schedules and stabilize prices so that buyers will not be compelled to shop around. Salesmen should use the firm name and not the individual's name, and they should make definite appointments in advance. Quality and service should be stressed instead of price. A pertinent suggestion is that foundries should localize their territories and concentrate their sales efforts instead of trying to cover so much ground.

While the outside point of view is important, and oftentimes is of valuable assistance in straightening out difficulties, and correcting poor practices, candid and frank opinion from within is not to be despised. Questionnaires sent to member foundries of the Steel Founders' society show that sales managers and executives are alive to selling problems, and undoubtedly when the problems are brought into the open and discussed rationally, corrective measures may be suggested and applied. Sales managers point out that often the salesmen have a price complex and are inclined to accept orders at cost or at less than cost. They also state that foundries ignorant of costs or those which cling to the old fallacy that volume brings profit, offer castings at prices less than cost. Many salesmen working on a commission basis only are after their commissions and volume, and are not concerned with profit or the success of the firm employing them.

Educational Work Necessary

Educational work is necessary to impress upon the salesmen the desirability of obtaining rightful customers whose class of work, plant location, etc., make them legitimate and logical customers. They also should be taught to look for new uses of steel castings in customers' plants, and should retain the same interest in customers as was exhibited when they were being acquired. Difficulties are encountered due to use of secret rebates and price concessions offered by some competitors, and to the employment of price schedules instead of individual job quotations.

To improve conditions in the steel foundry industry sales managers have indicated plans and policies they would like to inaugurate, and if only a few of these were adopted it would be a great gain for the steel foundry industry. Undoubtedly, if foundries only would accept business which covers cost and includes a satisfactory profit as is suggested, order would replace chaos. Other suggestions are the establishment of definite sales territories, selling of castings by the piece or pattern instead of on schedule, and the adoption of the one-bid policy.

Buyers' complaints on falling down on promises and delivery dates could be eliminated to a large degree if delivery dates only were given in writing after consultation with the production department, and salesmen were restrained from making verbal promises. Salesmen should be instructed to sell on quality and not on price, and the foundries should establish a price per pound schedule for each customer. Each foundry should determine the kind and class of castings representing the greatest profit to it, and concentrate on selling that type. Only the best pattern equipment should be accepted so that the finished job will be a credit to the foundry. Where pattern equipment is not right, see that it is made so.

Cite Price Cutting Evil

Reports from steel foundry executives indicate that 62 per cent of them believe that price cutting on the part of competitors is the greatest evil affecting the selling end of the business. Fourteen per cent state that salesmen talk too much about price and not enough about quality, service, and engineering problems. Unfair trade practices on the part of competitors in the matter of secret rebates, price concessions, etc., is said to be the greatest evil by 8 per cent. Four per cent each are divided on sales costs too high, purchasing agents are too price-minded, and not sufficiently quality-conscious, lack of firm bid policy, and the market is insufficiently developed.

Replies from foundry executives on why there is a tendency for salesmen to sell principally on price present a variety of reasons. Lack of salesmanship, weak sales management, lack of proper training, and the line of least resistance are suggested. Seeking of nothing but tonnage, and lack of knowledge of foundry costs are faults of salesmen. Oftentimes they are too anxious to make a sale, and slip up on the price. Other executives point out that overcapacity, continued use of schedules, and commission selling are responsible for selling on a price basis.

Forty-five per cent of the executives replying state that they have helped buyers form a better comprehension of their ability to supply the buyers' needs through sales representation in the field. Advertising, direct mail, etc., is reported by 33 per cent as accomplishing that service, and 22 per cent believe that through good service, performance or quality product, they have aided buyers in forming favorable opinions. Fifty-seven per cent suggest co-operative market research and development while the remainder offer individual market research to broaden the market for steel castings.

Common faults of some buyers are stated to be misrepresentation of price and delivery quotations received from other foundries, buying on price as a policy, indifferent to quality standards of different foundries, and unfamiliarity with the nature of their own castings requirements. Suggestions offered to get purchasing agents to discontinue shopping around include the impressing on the customer that he obtains only what he pays for, build confidence in the foundry's product by selling quality castings and giving good service, and greater co-operation among the foundries.

Questioned on how to discover and develop new uses for steel castings, 40 per cent believe that concentration on the customers' engineering departments and co-operation with them to develop new uses and better utilization will be of great value. Co-operative research and market development on the part of the society is suggested by 20 per cent while another 20 per cent recommends an intensive study by an individual employed for the purpose of discovering and developing new uses. Twelve per cent believe that a handbook and design data on steel castings should be placed in the hands of engineers and designers, and 4 per cent advocate the continuation of improvements in foundry practice which will make cast steel acceptable for additional uses.

Holds Research Trends Point To Progress

According to Dan M. Avey, editor, THE FOUNDRY, speaking at a meeting of the Philadelphia Foundrymen's association held at the Manufacturers Club, March 11, various agencies, including associations, groups and individual companies are contributing new information on castings manufacture. Research, effective in developing new processes and products, has been an active aid in setting the foundry industry forward during the past few years and will assure progress in the future. More that 70 firms in the industry or identified with the contributing branches of equipment or supply manufacture have active research programs.

An interesting account of the problems and mode of work in a large foundry in India, was given by James Duff, Staveley Coal & Iron Co., Chesterfield, England. Mr. Duff, who spent 17 years in charge of an Indian foundry will be the next speaker before the Philadelphia group, at its April meeting.

O. S. Kelly, district sales engineer in Southern Indiana, Southern Ohio and Kentucky for the C. O. Bartlett & Snow Co., Cleveland, the Foundry Equipment Co., Cleveland, and the Modern Pouring Device division of the Modern Equipment Co., Port Washington, Wis., has moved his office from the Kelly building, Springfield, O., to 408 Union Central building, Cincinnati.

Carbon Can Be Regulated By Cupola Practice

By Gottfrid Olson

CONTROL of carbon in the cupola is recognized today as an important factor in producing high quality gray iron castings. In the Sept. 15, 1930, issue of THE FOUNDRY in the section devoted to foundry problems, it was stated that it is difficult if not impossible to control the carbon content in mixing irons for the cupola. The author does not agree with that statement as he has done considerable work along that line with excellent results, and believes that others may be interested in what can be accomplished in controlling carbon in the cupola.

For all practical purposes carbon can be and should be controlled in the cupola. Otherwise how can the increasing demands on gray iron castings be met by the foundrymen? Manufacturers of gray iron castings are asked to meet specifications heretofore unheard of. Greater strength and improved machinability are two questions of great concern to the purchasers of castings, and the foundry industry if it wishes to remain in business, must meet the demand.

Has Low Operating Cost

Regardless of the many alloys that foundrymen use to improve their products, they should not loose sight of the fact that the cupola after all is the most important factor in producing gray iron castings. Its low cost of operation has made it a popular melting unit, and with careful control the cupola can produce metal of excellent quality. Therefore, it is necessary to learn how to operate the cupola scientifically and efficiently to supply a product that will meet the specified physical requirements. The author believes that chemical analyses are of less importance.

Some writers claim that carbon is an element that should not be considered in calculating mixtures for the cupola because it regulates itself. That idea is erroneous as will be shown later. Much is heard about semisteel, high test iron, pearlitic iron, etc., but what are they? Nothing but gray irons of better quality than the ordinary run-of-mine variety. They are produced by the same process employed for ordinary gray iron, with the addition of working closer to scientifically proved principles.

Density, strength and machinability are characteristics of a good gray iron, and to obtain those, the main requisite is the control of the carbon. When an iron has a fine crystalline structure with a total carbon around 2.70 per cent, and the combined carbon 0.80 per cent, it is said to be pearlitic. It possesses the greatest density and if melted under the proper conditions, it also has great strength and machines easily. As the carbon content of such iron is considerably lower than that obtained by using pig iron and cast scrap in the charge, varying quanti-

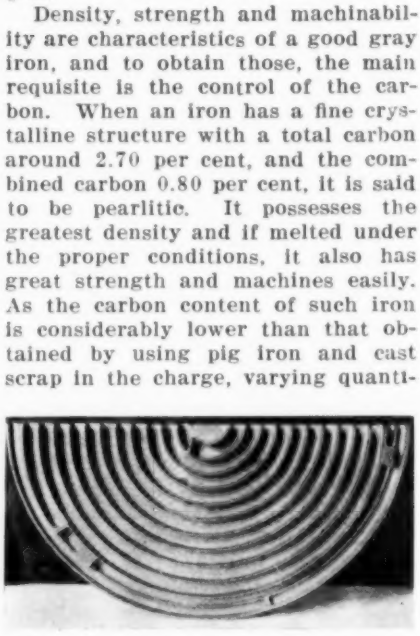


Fig. 1—One-half of Casting Showing Light Sections into which Low Carbon Iron May Be Poured

ties of steel scrap are used. In that connection, some data on differences in carbon pickup in the cupola will be of interest.

The accompanying table includes the percentage of steel scrap added to the charge, the amount of carbon in the metal charged into the cupola and that in the resulting metal, other elements in the metal, and the brinell hardness number of the resulting iron. The author has found in using 22 per cent steel scrap in the cupola that there was a variation in carbon of 0.12 per cent. The lowest was 3.02 per cent and the highest 3.14 per cent. However, that does not mean that by using 22 per cent steel, the carbons always will be within such limits, much depends on the man in charge of the cupola. As the percentage of steel charged is increased, the absorption of carbon increases, or it may be explained by saying that the lower the percentage of carbon in the charge, the greater will be the absorption of carbon in the cupola.

From the table it may be observed that with 50 per cent steel in the charge, 1.48 per cent carbon is charged into the cupola and 2.80 per cent carbon is found in the resulting metal or a gain of 1.32 per cent. With 25 per cent steel the carbon going in is 2.53 per cent while that coming out is 3.07 or a pickup of only 0.54 per cent. With the greatest amount of carbon going in with 22 per cent steel or 2.77 per cent, the carbon increase is 0.33 and 0.34 per cent. Using 60 per cent steel scrap additions, the author has found as high as 1.66 per cent carbon picked up in the cupola, but that was a rather high figure due to the fact that the cupola was running slow at the time.

Percentage Is Different

As mentioned previously when using 22 per cent, there was a variation of 0.12 per cent in the carbon. Using different quantities of steel scrap the carbons may be held within such limits with an outside maximum limit of 0.20 per cent. The table includes the high and low values for carbon in heats containing 25 per cent steel scrap additions as taken from the plant records. When using larger quantities of steel, say 50 per cent or more, the best results will be obtained by using low carbon pig irons which will bring the total carbon down to 2.80 per cent or under. The silicon may vary from 2.0 to 2.7 per cent, depending upon the class of castings to be made.

For example, a desirable mixture for diesel engine cylinders has the following composition: Total carbon, 2.55 per cent; combined carbon, 0.77 per cent; manganese, 0.54 per cent; phosphorus, 0.28 per cent; sulphur, 0.10 per cent; brinell hardness number, 255, and tensile strength, 43,000 pounds per square inch. Those not familiar with such a gray iron may say that it will be hard to machine. However, although the brinell value is 255 and the mixture contains 60 per cent steel, it machines easily. When carbons are arranged properly, there will be considerable difference between the analysis and hardness number of the iron as compared to those values considered in the case of ordinary iron.

That is illustrated clearly in the fol-

lowing analysis of a gray iron for light castings to be machined: Total carbon, 2.90 per cent; combined carbon, 0.70 per cent; silicon, 2.18 per cent; manganese, 0.57 per cent; phosphorus, 0.28 per cent, and sulphur, 0.118 per cent. The mixture contained 60 per cent steel, and the applicability of that iron for light work is shown in Fig. 1 which is one-half of a casting used for the chemical determinations mentioned. The complete casting is 8¾ inches in diameter. The heavy portion of the casting is ¼-inch thick and is surmounted by 12 concentric rings or ribs, 3/16-inch apart. The rings are 1/16-inch thick and ¼-inch deep. The rim of the casting, and the flat face are machined all over.

Practice Is Similar

Production of low carbon gray iron is not difficult as it does not differ materially from careful cupola practice. For the best results, the cupola should be equipped with a forehearth. The size of the forehearth will depend upon the size of the cupola. For a cupola 42 inches in diameter it is recommended that the forehearth should have a capacity of not less than 2000 pounds. For a 54-inch cupola the capacity should be 3500 pounds, and for a 72-inch cupola, 6000 pounds. The tuyeres should be set low, not over 12 inches from the sand bottom, and less will do. The tuyeres should be large enough to permit the air to enter the cupola under the following pressures: 7 to 9 ounces in a 42-inch cupola; 8 to 10 ounces in a 54-inch cupola, and 10 to 12 ounces in a 72-inch cupola.

Disregarding atmospheric conditions, which most foundries are doing, it is recommended that 27,000 cubic feet of air be supplied for each ton of iron melted. That is the actual volume to be delivered to the cupola, and allowance must be made if there are any leaks in the blast pipe from blower or fan to the cupola. The coke bed should extend 30 inches above the tops of the tuyeres, but it may be found that after considerable experience in handling the cupola, the bed may be reduced somewhat. One important feature is the preparation of the bed. It is not sufficient just to say that the bed should be a certain height. Many heats go wrong due to carelessness in making up the bed, and to obtain the best results a definite procedure should be followed.

After the kindling wood has been placed on the bottom of the cupola, throw in a small amount of coke, say one-sixth of the total bed charge, and light the fire. When the wood is burning freely, and the coke shows signs of redness, throw on one-third of the bed charge. After that has burned through throw on another third of the bed coke. Now only one-sixth of the bed coke remains, and after the coke which has been placed in the cupola has burned through evenly to the top, the remaining sixth is used to level off the bed before charging the iron.

Too much emphasis cannot be laid upon the importance of getting the cupola started right. Good semisteel or high test gray iron is not produced by guess, since every phase of cupola operation must be watched carefully. The next point is to see that the first iron charge is placed evenly in the cupola, and that the succeeding coke and iron charges also are distributed in a similar manner. One point on which there seems to be a difference of opinion, is that of moisture in the coke. In discussing that problem, with others, the author always has heard "beware of moisture in the coke", but he does not agree with that contention. Moisture in the coke should not be excessive, but less than 1 per cent is decidedly harmful as the coke burns out too quickly. That leaves the bed low, and causes cold iron. If the moisture is under 1 per cent, sprinkle the coke with water. Ash content of the coke should be around 7 to 8 per cent.

In conclusion, it may be said that the requisites for controlling the carbons and producing low carbon gray irons in the cupola are: A cupola forehearth; low tuyeres; correct tuyere ratio; proper amount of air supplied under proper pressure; rapid melting; high temperature in melting zone; large amounts of steel scrap; coke with approximately 7 per cent ash; and moisture not under 1 per cent.

Composition and Carbon Pickup

	Per Cent					
Steel in charge	22	22	22	25	25	50
Carbon in charge	2.77	2.77	2.72	2.71	2.53	1.48
Carbon in castings	3.11	3.10	3.11	3.14	3.07	2.80
Carbon absorbed	0.34	0.33	0.39	0.43	0.54	1.32
Silicon	1.34	1.62	1.90	1.68	1.33	2.59
Manganese	0.54	0.54	0.63	0.62	0.54	0.66
Phosphorus	0.56	0.48	0.41	0.48	0.59	0.33
Sulphur	0.11	0.12	0.12	0.11	0.13	0.11
Brinell number	255	228	228	228	269	241

Foundry Metallurgists Address Scrap Men

H. A. Schwartz, director of research, National Malleable & Steel Castings Co., Cleveland, and W. W. Kerlin, Gray Iron institute, Cleveland, addressed the members of the Institute of Scrap Iron & Steel Inc., at the meeting in Cleveland, March 10-12, discussing the part that various types of scrap play in the malleable and gray iron divisions of the foundry industry. Mr. Schwartz outlined methods used in making charges for malleable iron and explained that quite exacting conditions with regard to carbon content are imposed on the malleable foundrymen if he wishes to secure a high grade product. The use of cast iron scrap in the malleable industry is limited, not so much by its physical properties, as by its variations in analysis. Phosphorus was mentioned as being higher than desirable for malleable charges and also the increased use of alloys raises the uncertainty of the analysis and decreases the desirability. As a result, only a small proportion of gray iron scrap is used in the malleable foundry. Such elements as chromium, tin, zinc and aluminum are deleterious to the melt and the resultant castings, Mr. Schwartz explained. Nickel and aluminum, although not desirable, cause little damage if their presence is known. Rust also is detrimental. Alloy steels should not be used in charges. Mr. Schwartz explained that there are several processes used to produce malleable iron including the cupola, air furnace and the electric furnace, with variations of each process such as duplexing and triplexing.

Co-operation between the customer's chemist or foreman and the scrap dealer was mentioned by W. Worley Kerlin, assistant technical director, Gray Iron institute, as one method of supplying gray iron foundries with desirable scrap. Since the gray iron foundry cannot control melting process as easily as the steel plant, the gray iron foundry must depend upon the analysis of the metal going into the cupola. He mentioned that the smallest scrap desirable is 2½ pounds, provided the section is sufficiently large, since charges are made up within 5 pound limits. High test iron which uses from 10 to 90 per cent steel scrap in its production, offers the scrap dealer a new market for steel scrap. He also spoke of the use of borings in the cupola, explaining that because of thin section, such material is oxidized easily. If such material is used, it is briquetted to give a density of approximately 70 per cent of other metallic portions of the charge. Rails, cut to the proper length, were noted as good steel scrap for cupola charges. Thin flashings, because of oxidation, and rusty scrap should be avoided.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

STEEL

Suggests Patent Search

We are aware that a number of proprietary alloy steels are being manufactured, especially those containing considerable quantities of chromium and nickel. Do you have any information on whether an alloy steel containing comparatively small amounts of those elements, for example a steel containing 1½ per cent nickel and 1½ per cent chromium, is a proprietary development?

It is difficult to keep in touch with all the developments in the field of cast metals, but as far as we know, steel containing 1½ per cent nickel and 1½ per cent chromium is not proprietary. However, to be absolutely sure, it is suggested that a careful patent search be made by competent agencies.

GRAY IRON

Temperature Is High

Will you please advise us upon the analysis considered best suited for the production of grate bars, and other castings, such as hot air furnace pots which must withstand high temperatures?

Although many foundries producing furnaces use practically the same metal for pouring grate bars as for furnace pots, we suggest that a different mixture be used for the bars. White iron would be an excellent material for the purpose if it were not so brittle. The next best will be an iron with a mottled structure which will possess properties of both gray iron and white iron. Try a silicon content in the final metal around 1.25 per cent. If it shows a white fracture, increase the silicon slightly. The sulphur, phosphorus, and manganese should be maintained as in ordinary gray iron castings.

Furnace pots are made from iron containing from 2.25 to 2.30 per cent silicon. The sulphur should not be over 0.10 per cent, the phosphorus from 0.50 to 0.60 per cent, and the manganese around 0.60 per cent.

Q & A

Pressure Is Excessive

While the castings produced in our cupola apparently are satisfactory, it seems to me that oxidation of iron during the melting process is taking place. The latter idea has been gained from the appearance of the runner heads of the castings which are puffed and honey-combed at the end, and are turned black like the surface of a blow on a casting while still red. The cupola is lined to 37 inches and has 6 tuyeres, 4 x 10 inches. I believe that it originally had tuyeres 4 x 4 inches. I have increased the fan speed to obtain better penetration of the blast. The windbelt of the cupola is so filled with iron and slag that it has only about one-half its true capacity, but cannot be cleaned out.

From your description it is possible that oxidation of the iron may be taking place, due to using too high a blast. While you state that the tuyeres are 4 x 10 inches, it occurs to us that the measurement is taken at the opening at the lining, and that the true opening at the shell is the original 4 x 4 inches that you mention. If such is the case, it will be necessary to employ a pressure entirely out of reason to obtain the required volume of air. Therefore, we suggest that you examine the tuyeres at the shell to determine the dimensions. If it is as we suspect, remove the flaring tuyeres and substitute straight ones that have a 4 x 10-inch cross section throughout.

A 37-inch cupola will melt about 6 tons an hour, and your fan should be run at a speed to supply about 3000 cubic feet of air per minute. Use 1000-pound iron charges with 100-pound coke splits between charges. Put enough coke in the bed to bring it about 36-inches above the tuyeres. A windbelt full of iron and slag is bad, and steps should be taken to clean it out. Cut the rivets on one of the plates forming the windbelt and remove it so that you can clean out the windbelt. Instead of riveting it back in place, bolt it on using asbestos strips to form a gasket. Then it may be removed whenever necessary without any difficulty.

Q & A

Resists Fused Alkalies

We are interested particularly in making pots for melting caustic soda, hoes for agitating fused sodium sulphide, and cocks, valves and pumps for handling ammoniacal brine. Have you any data on suitable compositions for those castings? We melt iron in a 30-inch and a 36-inch cupola with forehearths. Steel scrap usually is added to the charges when required. Uniform iron is obtained with that practice. Do you know of any books or publications dealing with alkali and acid resisting castings?

A close, dense-grained iron, low in total carbon and usually low in sili-

con, is best for handling caustic and other alkaline fluids. The corrosion resistance is enhanced materially by the addition of nickel. While 1 to 2 per cent is somewhat helpful, 5 or 6 per cent increases the resistance. However, iron with that percentage is martensitic in structure, and hence quite hard. With 15 to 20 per cent nickel, the iron is gray and possesses excellent resistance even to hot, fused caustic.

As far as we know there are no books dealing exclusively with alkali and acid resisting castings from the foundry viewpoint. Two books that relate to acid resisting and chemical engineering apparatus include, "Acid Resisting Metals," by S. J. Tungay, and "Corrosion Tests and Materials of Construction for Chemical Engineering Apparatus," by Calcotte, and Whetzel.

Q & A

Structure Is Mottled

Will you give us the proper mixture for grate bars to withstand 1800 to 2200 degrees Fahr.? The mixture we are using at present consists of 50 per cent pig iron and 50 per cent scrap, but they do not stand up very well. The pig iron we use has the following analysis: silicon, 2.48 per cent; sulphur, 0.040 per cent; phosphorus, 0.59 per cent, and manganese, 0.82 per cent.

Cast iron will not stand up satisfactorily when exposed to temperatures ranging from 1800 to 2200 degrees Fahr. At 1800 degrees Fahr., the iron is weak, soft, and mushy, and grows and scales rapidly. A temperature of 2200 degrees Fahr. actually is above the freezing point of many cast irons.

However, if you are referring to grate bars which are subjected to the usual conditions of service in furnaces, we believe that you will find that an iron with a mottled structure will serve satisfactorily. White iron would be better, but it has a tendency to be brittle, and hence, sensitive to shocks and blows. The most suitable composition of the bars will depend on the section size. If the section is light, the silicon may be higher than when it is heavy. You probably will get the desired fracture by using 25 per cent steel scrap in your mixture and reducing the pig iron or the scrap.

Q & A

Gas May Be Present

Is it possible to melt a charge containing 100 per cent steel scrap in the cupola and obtain a sound casting from the molten metal without employing any deoxidizers? Will there be any measurable difference in the hardness of a metal made from a charge containing 100 per cent steel scrap, and one containing 75 per cent steel scrap and 25 per cent gray iron scrap containing 2 per cent silicon. Both charges to be melted in the cupola.

We doubt whether it will be possible to melt 100 per cent steel scrap in the cupola, and obtain sound castings without the use of some type of deoxidizer such as ferrosilicon or ferromanganese. Jennings in the *Transaction* of the A. F. A. 1926, describes the melting of 100 per cent steel scrap for making white iron grinding balls, and mentions the use of ferrosilicon. Hudson in the same volume also used 100 per cent steel scrap with additions of ferrosilicon and ferromanganese for producing gray iron castings of high quality.

Theoretically, if solid castings could be obtained from both types of charges mentioned, melted, poured and cooled under the same conditions, the all steel scrap mixture should be harder as it contains less silicon. That of course, assumes that the total carbon contents are approximately the same. If both bars are chilled completely, and one contains a higher carbon content than the other, the one with the highest carbon content will contain more cementite, and hence be harder.

However, if you are contemplating a choice between the two mixtures, it is suggested that you use the 75 per cent steel scrap-25 per cent gray iron scrap mixture. Without adding any ferrosilicon the metal will contain approximately 0.50 per cent silicon which will aid in deoxidizing without affecting the chill greatly.

GENERAL

Reject Pickled Iron

We are casting a great many lighting fixtures which are too light and fragile to be cleaned by tumbling, and we have been cleaning them by hose sandblasting. However, our capacity for cleaning by that method is insufficient to care for the output, and we resorted to acid pickling. Unfortunately, the customer rejected the castings cleaned by pickling as unsatisfactory for plating. We used a sulphuric acid solution in the proportion of 1 acid to 4 water. How can we remedy the condition?

It appears to us that your sulphuric acid solution is too concentrated. The suggested proportions are 1 part acid by volume to 10 parts water. Use the solution cold. Rinse the castings well in cold water, and then in hot. Dry in hot sawdust to remove all traces of moisture. Occasionally a solution of washing soda is used to neutralize the acid. Such a dip contains ¼-pound of washing soda to 1 gallon of water, and it may be used hot or cold.

A hydrofluoric acid solution often is used for removing sand from castings. The solution contains 1 part acid to 15 parts water. The castings should be rinsed in hot water containing a small quantity of lime. Hydrofluoric acid solutions attack the skin, and care should be observed to see that the acid is washed off immediately, and then apply ammonia water or washing soda or baking soda solutions.

Another acid solution used also for pickling iron and steel consists of 1 gallon of water and 1 gallon of hydrochloric (muriatic) acid with a specific gravity of 22 degrees Beaume. Use hot or cold, and wash in cold and then hot water. The principal thing to watch in using acid pickles is to see that all the acid is removed from the surface and pores of the castings. Do not be afraid of rinsing them thoroughly in cold and hot water alternately. Using hot water in the last rinse will help in drying.

Q & A

Iron Floats on Bath

I have observed that a solid piece of cast iron thrown upon a bath of molten metal will float on the surface. My understanding has been that solid cast iron is heavier than liquid cast iron, and hence should sink. Is there any explanation for that phenomenon?

The phenomenon you mention is not uncommon and is explained partly by the surface tension effect. It is illustrated rather strikingly by the timeworn experiment of carefully resting a needle on the surface of still water contained in a pan. It can be done if the needle is dry and its length is in the same plane as the water at the time it comes in contact with it. Greasing the needle makes it less difficult. In addition to the effect of surface tension, convection currents exist which have a tendency to hold the solid piece in suspension. A third factor probably is the expansion of the cold metal due to absorption of heat from the liquid metal.

Q & A

Core Causes Defect

We are forwarding a gear case casting, sawed in two to show a defect in one of the bosses, cast on the cope side. Approximately one-third of all these castings show this defect. Occasionally a similar defect appears in an adjoining boss. We have varied the style of gating and have tried a softer iron, but without effect. This casting is fairly typical of the class we handle but none of the others give any trouble.

The defect is caused by the single small dry sand core employed to form the small opening in the side wall of the casting in the immediate vicinity of and below the boss. The vent from this core does not escape freely through the sand. Evidence of a boiling action may be noted on the surface of the casting immediately below the boss. Some of this gas escapes, but some of it remains in the boss where it is trapped by the iron. Ob-

viously the remedy lies in providing a more permeable core and placing it in a print through which the gas may escape readily. As an extra precaution it may be advisable to place one or two vent holes in the core and then place one or two corresponding vent holes in the green sand print in the mold. Where the end of the core butts firmly against the outside wall of the mold the chances for the escaping gas are improved. Where the end of the core does not touch the green sand wall, the iron forms a thin film and effectually bars the escape of gas in that direction. Your method of gating and pouring the casting from two sides is quite satisfactory. If we might make a suggestion it would be to raise the top of the sprue another inch. The casting submitted shows no sign of shrinkage in the high bosses, but we should feel safer with a slightly higher head.

Q & A

Core Must Be Vented

We are making a combination manifold heater which has several ribs across the interior. If the core is made hard so that it will not draw moisture, it causes blows in the casting. When the core is made soft, it cannot be removed from the drier without breaking. We have tried several mixtures without success.

You do not state whether you are using oil or other type binders, or the dimensions of the core. Your reference to drawing moisture seems to indicate that you are employing other than an oil binder. If you have not tried linseed oil or a reputable proprietary core oil, we suggest that you make some of the cores with clean, sharp sand and oil using 1 part of oil to 50 parts of sand by volume. A stock core mixture using flour is given as 50 parts of clean silica sand; 1 part of good grade core oil, and 4 parts of wheat flour. Another mixture for medium and heavy cores for gray iron castings is composed of 80 parts of clean, open silica sand; 1 part of good grade core oil, and 1½ parts of corn flour. For other core mixtures we suggest that you study the material presented in "Hints for the Core Room," which appeared in THE FOUNDRY *Data Sheets* beginning Oct. 1, 1929.

If it is possible, we suggest that you try to vent the cores to the outside of the mold. Vents may be made by placing wires or rods of the proper diameter in the center of the core as it is being made. These are removed before baking, and leave a passage for the gases. To obtain full benefit of the vents, they must be carried through the sand of the mold.

MALLEABLE

Patterns Are Crowded

We are having some difficulty with malleable cast iron hubs which weigh about 16 pounds each. The hubs are made from a single pattern shown in Fig. 1 with the part marked A in Fig. 2 in the drag, and from a double pattern shown in Fig. 3 with the parts marked A in the cope. Some of the castings show holes in the part marked A which vary from pinholes to ½-inch in diameter. While it is difficult to distinguish whether the defective castings come from the single or double pattern, we believe that they come from the double pattern as more machining has to be done on those castings due to the position in the mold. The single pattern is molded in a 13 x 16-inch flask with 5½-inch copes and drags on a squeezer machine. The double pattern is molded in a 11 x 22-inch flask with 5½-inch cope and drag, and is hand rammed. Two heavy chills are used in the cores.

After examining the sketches carefully, it appears to us that your difficulty arises, not so much from the position of the cavity in the mold, as it does from the crowding in the case of the double pattern. The more logical method of mounting the patterns would be to follow the plan of the single pattern, that is to get as much of the casting as possible in the drag, as it usually is easier to feed, and any dirt that accidentally falls into the cavity generally is carried to the highest point. Consequently, foundrymen usually try to arrange the mold so that the less important surfaces are in the cope. Extra machining finish often is allowed on the cope.

If you will examine your double pattern you will notice that you have a large body of molten metal, namely the riser, which is separated from two other bodies on either side by only an inch of sand. Consequently it is not necessary to look much beyond that point for the cause of the holes. The riser raises the sand to a rather high temperature with the formation of large volumes of steam. The steam in seeking an outlet spreads toward the mold cavity where it meets steam formed by the metal rising at that point. However, since there is a greater body of metal in the riser, more steam at a higher pressure is formed, and it backs into the metal forming the casting making the holes that you mention. The size of the holes vary according to pressure formed.

There is a possibility that you may be able to eliminate your trouble by a thorough application of a heavy vent wire in the vicinities between the riser and the mold cavities. It is suggested however, that single riser be removed, and two others in other positions be substituted for it. Two reasons are behind that suggestion. The first has been given, and the second is that a riser is placed on a casting so that a reservoir of liquid metal is available to feed the casting as the volume contracts or shrinks during solidification. While the single riser as now placed undoubtedly does feed the casting, it would contain hotter, more liquid iron if it were placed in the gate or runner leading from the sprue to the casting.

With your present flasks and pattern plates, it probably will be difficult to arrange the risers as suggested without getting into somewhat the same trouble you now have, that is crowding. Therefore, the easiest way will be to reverse your patterns in the double plate so that the part marked *A* on the casting will be in the drag as is done in the case of the single pattern. The method of gating and risering probably would not have to be changed as only about 1 inch of the casting will project into the cope.

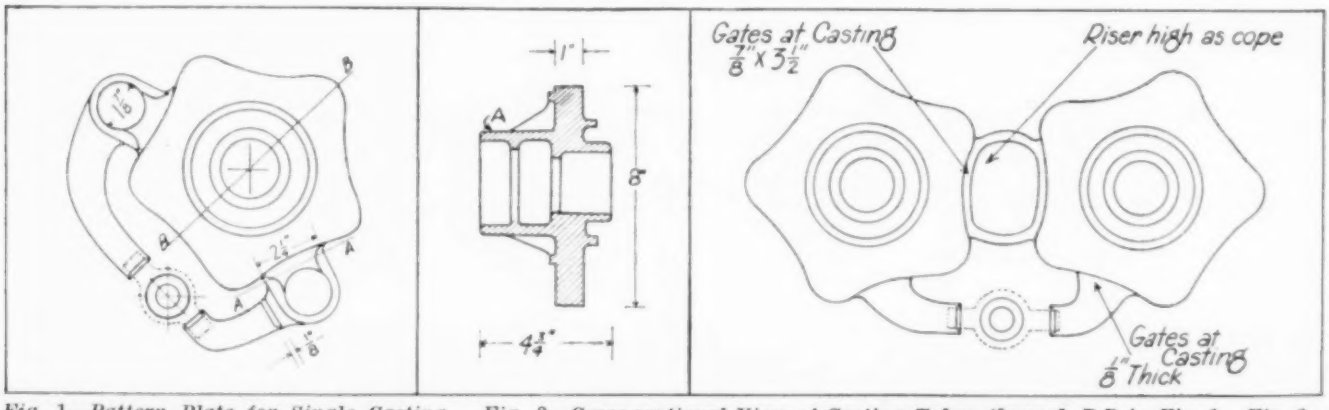


Fig. 1—Pattern Plate for Single Casting. Fig. 2—Cross-sectional View of Casting Taken through B-B in Fig. 1. Fig. 3—Pattern Plate for Double Casting Showing Gates and Common Riser

The FOUNDRY Family Photograph Album

Upper Left

M. W. POHLMAN

J. W. Pohlman Foundry Co., Buffalo

Upper Right

MAX KUNIANSKY

Lynchburg Foundry Co., Radford, Va.

Lower Left

H. L. ZIMMERMAN

Kuznetskstroy, Kuznetsk, Siberia, U. S. S. R.

Lower Right

W. H. J. CLUFF

Frederic B. Stevens Inc., Detroit

REGULATIONS FOR THE INSTALLATION OF

PULVERIZED FUEL SYSTEMS

(Continued from Data Sheet No. 854)

drop in temperature in milling and will go to the pulverized coal storage at considerably lower temperatures, provided the milling system is properly vented to release the moisture given off in grinding. If no water is evaporated, there will be only a small drop in temperature. Whenever pulverized coal or crushed coal are stored in the plant, a regular daily inspection should be made to see that there are no fires or overheating.

APPENDIX B

Recommended Procedure for the Extinguishment of Fires in Pulverized Fuel Conveyors, Pipes, Ducts, Collectors and Bins

The difficulty in extinguishing fires of the type noted above is recognized by all persons who have had any material experience in connection with the operation or maintenance of a pulverized fuel plant. Fires which otherwise would have been of slight extent have spread beyond the incipient stage owing to the application of improper extinguishing methods due to the lack of experience. For purposes of general information and guidance to those who may be called upon to aid or direct such fire extinguishing operations, the following procedure governing such fire fighting operations is given:

FIRES IN CONVEYORS, PIPES, DUCTS OR COLLECTORS

In case fire is discovered in pulverized fuel conveyors, pipes, ducts, or collectors:

1. Stop coal supply as quickly as possible.
2. Stop air supply as quickly as possible.
3. Close all vents and gates and inspect all vents and gates which should close automatically.
4. Introduce steam, carbon dioxide or other inert gas. It is suggested that pipe connections be provided on all such equipment for the ready introduction of the extinguishing medium. Such connections should not be less than 1 inch.
5. If fire extinguisher cannot be applied or is ineffective, water may be introduced. Care should be taken not to use a high pressure stream which would create dust clouds which would be an explosion hazard. Water should be used only under supervision of responsible authorities.
6. Procedure after fire is out will depend entirely on local conditions. In general, the equipment should not be put into operation until it has been thoroughly cleaned.

FIRES IN PULVERIZED FUEL BINS

In case fire occurs in a pulverized fuel bin:

1. Stop coal supply to bin.
2. Stop carrier air to bin.
3. Close bin vent damper or if it is automatic make sure it is tight.

(Concluded on Data Sheet No. 856)

REGULATIONS FOR THE INSTALLATION OF

PULVERIZED FUEL SYSTEMS

(Concluded from Data Sheet No. 855)

4. Make sure that all other openings into bin, other than feeders are tight.
5. Notify foreman and fireman.
6. Foreman should size up situation to see if fire has been caught quickly enough to be snuffed out by its own fumes.
7. If necessary introduce steam or inert gas. It is suggested that 1 inch or 2 inch pipe connection or small hand hole be provided in the top of bin for this purpose.
8. If fire has made considerable headway before being discovered so that vent damper has been damaged or seams have opened, it is imperative that every effort be made to close these openings with water-soaked bags or similar material. If the material used is combustible it should be kept wet.
9. The use of large quantities of water inside the bin should be avoided because it is of practically no value in putting out fire in large quantities of pulverized fuel, and because it makes it almost impossible to use the feeders.
10. The bin should be emptied as quickly as possible, even while fire is in progress, by feeding coal to the furnace. This should be done in spite of difficulties with feeders due to lumps of coke.
11. If coal cannot all be fed to furnace through feeders, the fire should be completely extinguished before the bin is opened.
12. After the fire is out and the bin is opened as much coal as possible should be scraped from the side walls with rods manipulated through the manhole on top of the bunker. If coke jams the feeders an attempt should be made to break it up with rods. If this fails, men must enter the bin.
13. Before men enter the bin it shall be thoroughly aired for several hours to eliminate fumes and to test whether fire is really out. The bin should then be entered only on authority of responsible persons, and the men shall wear oxygen breathing apparatus and have ropes around their waists held by men outside the bin. The men in the bin shall be watched continuously unless the fire has been out and the bin opened for at least 24 hours.

Practically all fires can be extinguished and coal can be fed through the feeders without the emergency measures discussed above in Sections 6 to 13, unless there has been negligence in routine inspection of bin. Routine inspection should consisi in opening such bin once a day. A man putting his head within the manhole can determine whether there is any unusual increase in bin temperature or in fumes from smoldering fire, and if he temporarily turns out his light he may be able to notice a dull red glow. Such inspections of course, should not be made while bin is being filled nor until dust is settled after a filling period.

The following might be added to recommendation on bin fires:

14. The bin need not be emptied after a fire unless so much coke has been formed that it jeopardizes safe feeder and burner operation.

It is not safe operation if intermittent feeding and burning results in deposits of unburned fuel in the furnace.

In this case the bunker should be emptied without burning the coal, either by disconnecting feed pipe and discharging to buckets, or by filling buckets in bunker and taking them out through the manhole in the top. Under no circumstances should the coal be freely discharged to floor or sluiceway through openings in bottom of bunker.

THE FOUNDRY DATA SHEET, APRIL 1, 1931

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Problems in Nonferrous Founding

By Charles Vickers

Melts Bronze in Cupola

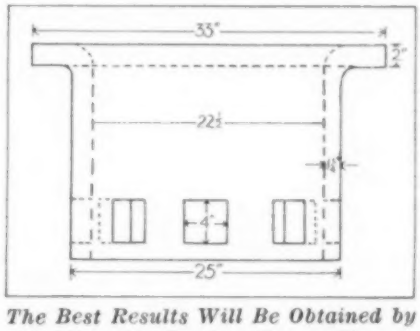
Could you advise me of the safest method of manipulating a 40-inch inside diameter cupola to melt gun metal, using either ingot metal or scrap. We suppose it would be necessary to make a new bottom or bed (ours is the solid type bottom cupola) and see that the well is thoroughly free of iron. Also, to avoid oxidation I am presuming that about one-third the volume of air used for melting iron would melt gun metal. The cupola is arranged with six tuyeres, 8 x 5 inches at the belt, and flared to 13 x 5 inches at the lining in one row at a height of 2 feet from the bed.

Is it advisable to cast gun metal or brass as it is usually called with small gates on top, as is sometimes done with deep cylindrical iron castings? A short while ago we had a flanged cylinder to cast in bronze; it was 33 inches diameter across the flanged end, 25 inches at the plain end, and 22½ inches diameter inside, and there were eight equidistant square openings or ports cutting through at the end opposite the flange. The cylinder was 20 inches long and from 2 to 1¼ inches thick. The weight of the casting is 730 pounds.

There is not the least doubt but that a 40-inch cupola will melt 1000 pounds of brass easily on a pinch, but it does seem a waste to use such a large furnace for such a small amount of brass. A 40-inch cupola ought to melt about 6 tons of cast iron an hour, and therefore 1000 pounds of brass ought to be melted and hot in 10 minutes. We suggest the mold be made, dried and all ready to put together the previous day, for it is evident that after melting iron, the cupola cannot be made ready for the brass. A new bottom will have to be made, and the crucible of the furnace cleaned of iron droplets, and washed over with some suitable refractory. The great thing to avoid is iron contamination, because it will melt, and exist in the bronze as hard particles.

Bronze is melted every day in cupolas and some brass foundries are equipped with no other melting furnace. The cupolas are small in size being around 22 inches diameter, and use a low sulphur coke. In such cupolas a bed 17 inches thick will bring down a heat of low-zinc brass, or red brass in 10 minutes, at a temperature of 2250 degrees Fahr. The heat weighs 500 pounds. The same size heat also comes down in 10 minutes using a bed 22 inches thick, and the temperature will be 2300-2400 degrees Fahr. The height of the bed coke regulates the brass temperature.

For your work bring the brass to around 2350 degrees Fahr., or even higher, governing this by the length



The Best Results Will Be Obtained by Molding the Casting Flange Down

of time it will take to reach mold side. There will be little time for oxidation due to the rapidity of melting, which should be followed by getting the brass out of the cupola as quickly as possible. Let it stand in the hot ladle awhile before pouring it, so that it can free itself of dissolved gases. That is the advantage of bringing it down into the ladle at quite a high temperature. Use about 0.25 per cent phosphor-copper and put it in the bottom of the ladle and tap onto it. Also have a layer of glowing charcoal in the bottom of the ladle.

As mentioned, the blast can be softened a bit for melting brass, but what is wanted is heat enough to bring the metal down in short time, the quicker the better. It takes time to oxidize brass, and also to aerate it.

In spite of the fact that the lower two-thirds of the casting is the working face, it is safest to mold and cast it flange down, for the port holes when at the bottom generally aerate a brass casting so that holes appear under the flange. Use high heads above the cope. A cylinder of that metal thickness can be poured from one sprue, with a square gate top and bottom. If risers are used make them worth while, about 3 inches in diameter and 10 inches or so high. The pouring head should be no higher than the top of the cope and be connected by a short runner to the main sprue. When filled, it is covered with molding sand. Then a weight is bedded on, and the high risers can be touched up, with hot metal brought from the brass furnace in a crucible. Have sand from which the gases can easily escape, a well vented mold, and hot metal.

Gun metal is frequently gated with small gates on top in the manner mentioned. In fact the same methods often used for iron give good results with brass. The modern idea is small gates that can be choked to keep the heads filled while pouring.

Q & A

Heat Treats Aluminum

We have an inquiry for aluminum castings to be heat treated, and would like to know the analysis of metal best adapted for that purpose. We also would like information on the method of heat treatment, etc.

Most of the aluminum alloys amenable to heat treatment are patented, and it is suggested that you look into that phase before proceeding. However, we believe that suitable alloys may be purchased from the manufacturers with data on desirable heat treatments. For example, one alloy suitable for heat treatment contains 96 per cent aluminum and 4 per cent copper. It is heat treated at 968 degrees Fahr. for 24 hours and water-quenched. Through heat treatment the strength of sand-cast test bars has been increased from 18,000 pounds per square inch to 36,000 pounds per square inch, and the elongation from about 4 per cent to 10 per cent. The brinell hardness number of the heat treated alloy is around 70.

Another alloy suitable for heat treatment is made with 83.25 pounds of aluminum; 14 pounds of an alloy containing 99 per cent aluminum and 1 per cent silicon; 2 pounds of copper, and 0.75 pounds of iron. The alloy is heat treated at 960 degrees Fahr. for 22 hours, and quenched in water.

GRAY IRON

Possesses

Valuable Engineering Properties

IN A BROAD sense heat treatment implies any thermal treatment whose aim is to alter the properties of any material obtained in everyday manufacturing practice. In the narrower and more usual sense it means thermal treatment of cast or worked material, which treatment is designed to change the properties obtained in the usual manufacturing processes. As examples of the former, superheating of molten cast iron to destroy graphite neuclei is a heat treatment. Likewise pouring the molten metal into heated molds, or against chills, are thermal treatments at variance with the usual foundry practice of casting gray iron into sand molds.

Three Methods Used

Confining the discussion for the moment to the second definition, and limiting it to a consideration of thermal treatment of the product cast in the more usual way, three typical heat treatments are found: (1) Annealing or normalizing at the temperature below the critical point to relieve internal stresses and avoid warpage. (2) Annealing above the critical point to soften the casting and increase machinability. (3) Quenching (with or without subsequent tempering) to harden and strengthen the casting.

Structural changes taking place in a gray iron casting depend on the temperature to which it is exposed, the duration of exposure, and the rate of cooling from the temperature to which the iron was exposed. The conditions and phenomena encountered on heating a piece of iron are the reverse of those met on cooling from the liquid state as explained in Part XIV, and it will be worth while to compare the previous remarks about the changes on cooling with those which will be presented.

Heat Treat Iron

WHILE gray iron as cast possesses properties that are suitable for many applications, it often happens that further treatment is desirable to change or enhance certain characteristics. The process usually is one of heat treatment, and that is applied to relieve strains, decrease the hardness value so that the iron may be machined more easily, etc. This article discusses the theory involved, and the temperatures applied to obtain the desired results. The electrical properties of gray iron also are described.

On heating gray iron becomes somewhat more plastic, it takes less stress to produce a given strain. This is evident from consideration of the diagram Fig. 89. On short anneals up to about 900 degrees Fahr. no notable changes are made in strength or brinell or microstructure, test pieces being examined at room temperature after annealing has been completed. At 900 degrees, prolonged exposure affects some softening in certain irons, usually the weak open-grained type. This condition primarily is due to slow graphitization and may be followed or accompanied by growth phenomena.

Short Anneal Is Beneficial

Therefore, short time annealing at 900 degrees Fahr. or below has no deleterious effect on the properties of the metal, yet increases its plasticity at the temperature. It is well known that many castings have severe internal stresses. These stresses generally are caused by illogical design or poor foundry practice, no allowance having been made for the normal contractions which occur when cooling from casting temperature. To illustrate that point, consider a casting made in cross section like a letter I, the center web being

Table XIII

Removes Casting Strains

Author	Annealing Temperature, Deg. Fahr.	Time in Hours	Cooling Rate
Anonymous	1100	8	slow (24 hr.)
Sherwin	1100	24	slow
	400	24	slow
Hurst	1067	72	slow
	1067	750	slow
Wiltshire	700	7	slow
Harper and MacPherran	1150	1	slow
Rolfe	1100	1	slow
Bolton	700 to 1000	....	slow
Donaldson	842 to 1022	....	slow
Grotts	600	....	slow
Capp	932 to 1022	4 to 10	slow
Bolton	700 to 800	....	slow

Table XIV

Dead Annealing Temperatures

Author	Annealing Temperature, Deg. Fahr.	Time in Hours	Cooling
Evans	1400		3 hr. to 800 deg. Fahr.
	1650		3 hr. to 800 deg.
Piwowarski	1500	5 min.	1 hr. through 1350 deg. Fahr.
Schuz	1382 to 1472	3 to 10 hr.	slow
Harper and MacPherran	1450 to 1550		slow
Schaap	1600		slow to black heat
Potter	1600	2-3	slow
Bolton	1600	depends on size	slow
Priester and Curran	1460 to 1650	3	slow to 1500 deg.
Knowlton	1700		Fahr. and water quench

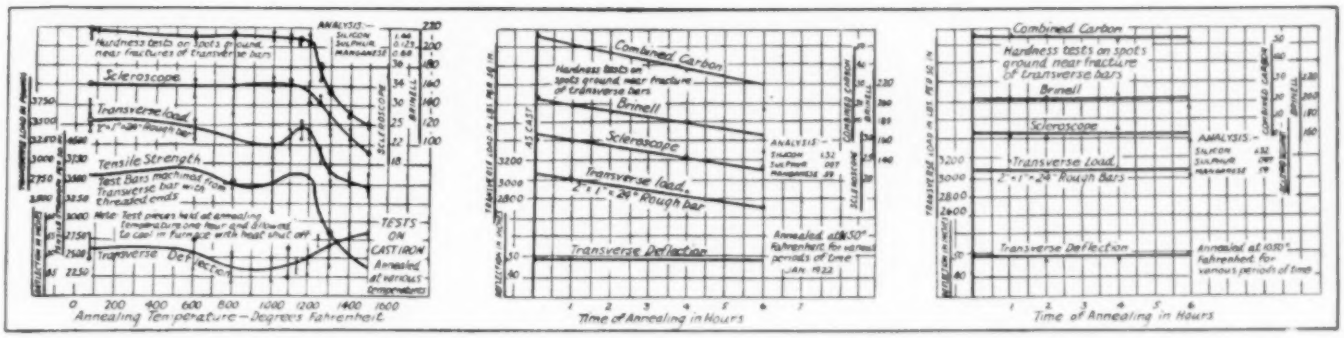

Hardness tests on spots ground near fractures of transverse bars
Scleroscope
Transverse load
2"x1"x28" Rough bar
Tensile Strength
Test Bars machined from Transverse bar with threaded ends
Transverse Deflection
TESTS ON CAST IRON Annealed at various temperatures
Annealing Temperature—Degrees Fahrenheit
Combined Carbon
Hardness tests on spots ground near fracture of transverse bars
Brinell
Sclerescope
Transverse load
2"x1"x28" Rough bar
Transverse Deflection
Annealed at 1050° Fahrenheit for various periods of time
Time of Annealing in Hours
Combined Carbon
Hardness tests on spots ground near fracture of transverse bars
Brinell
Scleroscope
Transverse Load
2"x1"x28" Rough Bars
Transverse Deflection
Annealed at 1050° Fahrenheit for various periods of time
Time of Annealing in Hours

Fig. 91—Results Obtained on Cast Irons Annealed at Various Temperatures. Fig. 92—Iron Annealed at 1150 Degrees for Varying Periods. Fig. 93—Iron Annealed at 1050 Degrees for Varying Periods. Tests Made by MacPherran and Fletcher

3 feet long, 3 inches wide, and ½-inch thick.

Imagine such a casting being made in a hard unyielding baked sand mold. Since both ends are anchored, and the contractive forces are great, it is fairly certain that the web will crack. There are many cases when contractive stresses are not sufficient to crack the casting, yet remain bottled up, as it were. Such castings may be broken or cracked easily, or when machined, they are likely to warp or distort. The latter phenomenon particularly has been a source of irritation for machine shop foreman.

In all heat treatment, iron castings should be brought to temperature slowly or cracks are likely to result. Also proper precautions should be taken to prevent too severe contractive forces on cooling. Recommendations of various investigators for artificial aging or annealing to relieve stresses only, as assembled by Marbaker, are shown in Table XIII.

Critical Point Varies

When cooling down from molten condition the critical point or eutectoid arrest in gray iron is found at about 1350 degrees Fahr. At this point the saturated austenite remaining is converted into pearlite. The exact temperature varies somewhat according to the composition of the iron and the rate of cooling of the test piece. Cooling curves of a gray iron, showing the thermal arrests are presented in Figs. 76 and 77 on page 79 in the Dec. 1, 1930, issue.

On heating up the reverse phenomena occur. Any pearlite is converted into austenite when heated above the critical point. The critical point on heating is somewhat higher than that found on cooling, because of lag. If cooling were slow enough the critical points on heating and on cooling probably would coincide. At the critical point on heating, say about 1400 degrees Fahr., in presence of sufficient silicon, the solubility or carbon in the austenite is quite low, so if much combined carbon is left most of it will be broken down into graphite and ferrite.

Rapid dead annealing of gray iron is accomplished by bringing the castings to 1400 degrees Fahr. or slightly above, holding long enough to insure heat penetration or thorough soaking, then cooling slowly to well below the critical point. For annealing to increase softness and machinability in minimum time with minimum weakening effect, 1400 degrees Fahr. should not be exceeded greatly for ordinary gray irons. Above this temperature prolonged exposure causes grain growth of the graphite. Recommendations of various investigators, as assembled by Marbaker, are shown in Table XIV. The mechanical effects of annealing on various grades of iron are shown in Figs, 91, 92, 93, 94, 95 and 96. Fig. 96 is taken from an article by H. Bornstein in *Fuels and Furnaces*, September, 1929.

If the iron is mottled or chilled, containing free cementite, a higher annealing temperature is needed. For the ordinary run of foundry irons 1650 to 1750 degrees Fahr. is sufficient. The time necessary depends on the analysis of the iron, the amount of free cementite and on the thickness of the section.

On rapid cooling (chilling) from the liquid state, forms like cementite, ledeburite, prima austenite, etc. are preserved wholly or partially, as the quick cooling does not allow break-down of these structures. The reactions take time—time which is denied by the chilling action. In the same way if irons are brought above 1400 degrees Fahr. and cooled rapidly (quenched) the structure existing at the higher temperatures is preserved at least partially. That is shown in experiments by Bolton in THE FOUNDRY, Aug. 15, 1923.

Properties Are Changed

Samples of gray iron made from mixture containing 20 per cent steel scrap were quenched from 1400 to 1500 and 1600 degrees Fahr. and drawn to 700 degrees Fahr. etc. As shown in Figs. 97 and 98 material changes occur in hardness and strength properties. For example by quenching from 1600 degrees Fahr. and drawing to 700 degrees Fahr. (the draw being to relieve casting strains) hardness is increased from

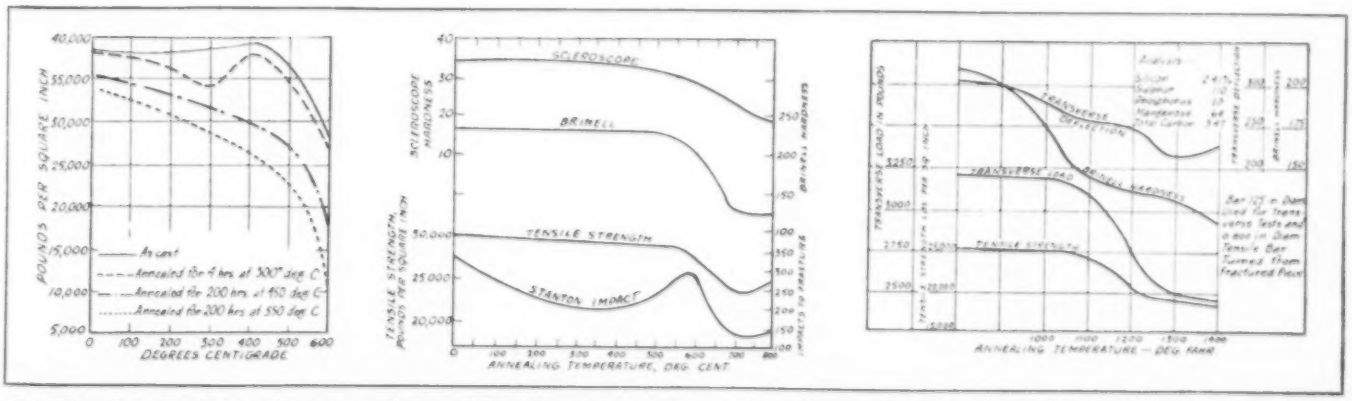


Fig. 94—Tensile Strength of Cast Iron at Elevated Temperatures According to Donaldson. Fig. 95—Hardness and Tensile Strength of Cast Iron Pistons Are Affected by Annealing Temperature (Rolfe). Fig. 96—Change in Properties of Gray Iron After Annealing According to Bornstein

200 to 380 brinell, due to retention of hard martensite. The relationships of time and temperature are critical and apparent anomolies will be encountered unless the mechanisms of the reactions are kept clearly in mind.

Take for example an iron heated to 1450 degrees Fahr. held at that temperature until thoroughly soaked, then quenched. Since equilibrium at that temperature calls for little dissolved carbide, the quenched iron is likely to be quite soft. On the other hand if we take an iron containing 0.60 or 0.70 per cent combined carbon, heat it rapidly to 1450 degrees Fahr., allow little time for further separation of graphite from the austenite, and quench we may get decided hardening.

As the temperature is increased, more and more carbide is normally in solution and the harder the iron is likely to be on quenching. However, such iron is not carbide and austenite like chilled or white iron—not at all. When at high temperature the heat-treated iron is austenite and graphite. Even with rapid quenching the austenite is not preserved fully at lower temperatures. Its stable form below the critical is pearlite, but in quenching insufficient time has been allowed for the austenite-pearlite reaction to take place.

What happens? Transition forms occur. On rapid quenching martensite is the characteristic form. On somewhat less drastic quenching troostite and sorbite may be formed. As shown in Figs. 97 and 98 drawing at elevated temperatures breaks down some of the unstable transition forms. In the example just referred to drawing the 1600 degrees Fahr. quenched specimen to 1200 degrees Fahr. lowered the hardness from 380 to 235 brinell.

The effects of various elements on the critical points and heat treatment reactions have not been understood generally. The critical point varies somewhat according to the composition of the iron. It is raised some 50 degrees Fahr. for each additional percentage of silicon and lowered approximately 45 degrees Fahr. for each additional percentage of manganese. Inasmuch as manganese percentage varies little in the ordinary run of irons the latter effect is not so great a factor. Nickel lowers the critical point decidedly—indeed to such a degree that at about 20 per cent nickel in the matrix, the metal is practically austenitic.

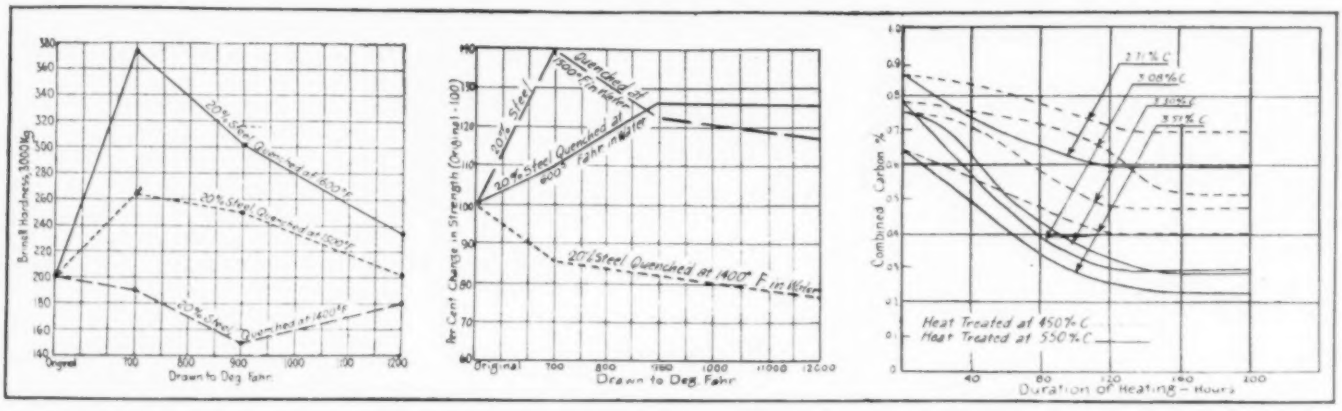
The phosphorus critical point is near 1800 degrees Fahr. Iron held above this point then quenched will have most of the steadite dissolved, as shown by Bolton in Fig. 100. One of the most complete investigations undertaken to establish the effects of various common elements on the annealing characteristics of gray iron is that by Donaldson *Foundry Trade Journal*, Oct. 25, 1928. Some of his results are shown in Figs. 99, 101, 102 and 103.

Short time tests indicate that some physical properties of most gray irons, for example strength and hardness, are unimpaired in the range 100 degrees below zero Fahr. to 800 degrees Fahr. Endurance limit is unimpaired from room temperature to 800 degrees Fahr. At the higher temperatures all irons examined show some lowering in comparative elastic moduli. Open grained irons have been known to exhibit corrosion growth at lower temperatures as mentioned in Parts XI, XII and XIII. Some high test irons are little effected up to 900 degrees in ultimate strength or by growth, and may be used safely in some applications. However, applications for severe service even at 750 degrees Fahr. should be limited to best grades of iron. The safety factor should be conservative pending results on flow or creep tests, and applications where impact is a possibility should be undertaken only after careful and conservative consideration.

Aging at 900 degrees Fahr. for a few hours eliminates casting strains, and danger of warpage. That method is more economical than the older methods when periods of months often were required for aging at atmospheric temperatures. There is no apparent change in physical properties on aging for short periods at 900 degrees Fahr.

Annealing at 1400 degrees Fahr. or above, followed by slow cooling softens the gray iron, makes it machine easily and uniformly, yet lowers tensile strength and certain types of wear resistance. Higher temperatures are needed for irons containing free cementite and those may reach 1650 to 1750 degrees Fahr.

Quenching from well above the critical increases the hardness, static strength and brittleness. Greatest hardness is obtained by quenching from 1600 to 1800 degrees Fahr. At 1800 degrees the metal is too plastic to be handled easily, and the phosphide component, steadite, is absorbed at that temperature. Practical experience shows that the hardened martensitic irons have exceptional wearing properties, retaining the freedom from seizing characteristic of gray irons, yet having much better abrasion resistance than untreated irons.


Brinell Hardness, 3000 Kg.
20% Steel Quenched at 1600°F.
20% Steel Quenched at 1400°F.
20% Steel Drawn Heat at 1400°F.
Drawn to Deg. Fahr.
Per Cent Change in Strength (Original = 100)
Original Steel
Quenched at 1600°F in Water
20% Steel Quenched at 1600° Fahr. in Water
20% Steel Quenched at 1400° F. in Water
Drawn to Deg. Fahr.
Combined Carbon %
2.11% C
1.08% C
1.05% C
.77% C
Heat Treated at 450°F.C
Heat Treated at 550°F.C
Duration of Heating — Hours

Figs. 97 and 98—Changes in Brinell Hardness and Tensile Strength of 20 Per Cent Steel Mixtures After Heat Treatments. Fig. 99—Change in Combined Carbon Due to Heat Treatment According to Donaldson

More and more carbide is normally in solution and the harder the iron is likely to be on quenching. However, such iron is not carbide and austenite like chilled or white iron—not at all. When at high temperature the heat-treated iron is austenite and graphite. Even with rapid quenching the austenite is not preserved fully at lower temperatures. Its stable form below the critical is pearlite, but in quenching insufficient time has been allowed for the austenite-pearlite reaction to take place.

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Electrical and magnetic properties of gray iron are of practical interest from several points of view. The use of cast iron in electrical machinery offers many problems to the designer. Use of magnetic measurements to determine the soundness of certain castings is an interesting possibility. Electrical, particularly magnetic, changes coincidental with phase changes have application in heat treating methods. Production of nonmagnetic castings may anticipate some demands for material with these characteristics. Existent electrolytic potentials between components are important from a corrosion viewpoint.

Electrical and magnetic properties of gray iron to some degree are predictable from the properties of its components. Graphite, for example, is a well known resister to current passage, and is nonmagnetic. Ferrite, particularly ferrite containing con-

siderable silicon is a fair conductor and has rather high magnetic permeability. Addition of silicon forming silico-ferrite, increases the permeability and the electrical resistance at the same time reducing the magnetic retentivity (opposed to coercive force). The cementite lamellae of the pearlite eutectoid retains magnetism well, and the *combined* carbon increases the resistivity. Most authorities claim that phosphorus, in ordinary amounts, has little effect on the magnetic and electrical properties.

Effects of various elements may be effective directly, or through action on the structure of the material. As a broad generalism, the electrical properties of an aggregate (such as gray iron) are additive functions of its components. The most apparent exception to this lies in the formation of solid solutions in various components of the aggregate.

Nickel Reduces Permeability

One of the most careful and thorough researches on the magnetic and electrical properties of cast iron is that by H. J. Partridge, Carnegie Scholarship *Memoirs*, 1928. He concludes. "The highest magnetic induction and permeability are obtained with cast iron which has been annealed (hence all silico-ferrite and graphite). If carbon is 'present as graphite in the nodular form,' high induction is obtained; if in the form of flakes the specimen possesses low magnetic induction. If the ground mass is ferrite, low hysterisis loss and high permeability appear to be fundamental properties of the material. If the specimen has a pearlitic matrix, it will also possess high hysterisis loss and comparatively low permeability.

"Graphite does not affect the hysterisis loss, but prevents the attainment of high magnetic induction. This is due to lack of magnetic continuity of the structure. This lack of continuity causes small demagnetizing forces to act within the specimen. The addition of nickel decreases the magnetic permeability of cast iron to such an extent that it becomes practically nonmagnetic when about 15 per cent of this element is present. Cobalt increases the induction, remanent magnetization, and permeability when added to cast iron, the high induction being due to the graphite existing in a fine state of division. The presence of this element also increases the density, but it has little effect on the coercive force and hysterisis loss, both of which are high. Annealing increases the maximum permeability and decreases the hysterisis loss, coercive force, and remanent magnetism.

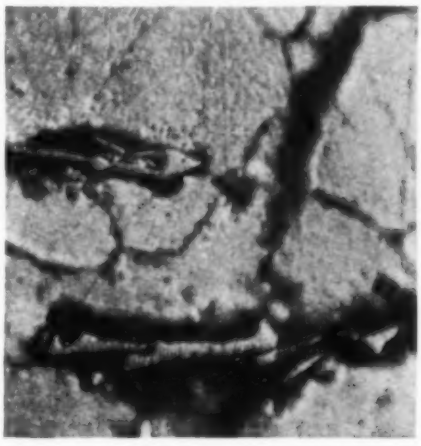


Fig. 100—*Absorption of Phosphide at* 1800 *Degrees Fahr.* 750 *Diameters*

Quoting further "The author has shown—that it is possible to produce this material (cast iron) with an hysterisis loss equal to that of soft iron, certainly less than that of wrought iron or mild steel. Frames made of cast iron possessing these properties could be used in the electrical industry, poles could be cast en-bloc with the frame—. Cast iron also has the advantage of very high electrical resistance which would reduce eddy currents in the case of an alternating-current generator.—"

From this and other work we see that thoroughly annealed low carbon iron rather high in silicon possesses desirable magnetic properties for alternating and intermittent currents—such as alternating-current machinery and solenoid cores on make and break circuits. For permanent magnets Ashworth and Pierce (National Physical laboratories, 1905) have shown that white iron low in silicon may possess decided advantages as it has high retentivity.

When heated above the critical range the magnetic pearlite changes to nonmagnetic austenite. This change is the basis of an electrical method for the determination of heat treatment temperature. Certain elements, notably nickel, lower this critical range to such a degree that at about 15 per cent nickel the material is austenitic at room temperatures and hence nonmagnetic. A high nickel-manganese iron developed by Dawson is nonmagnetic. Cast iron containing 20 per cent monel metal which was developed by the International Nickel Co. is practically nonmagnetic.

Field Is Limited

As a straight resistor or as a conductor it would appear that cast iron has a limited field. Its resistance is fairly high, yet at elevated temperature it oxidizes rather readily. In electromagnetic applications cast iron has not been given proper consideration because its properties are too little understood and improper grades were used—a not unusual reason for similar condemnations of this low cost and easily formed metal.

Insofar as electrolytic potential effects are concerned, the presence of graphite is a detriment to corrosion resistance—the galvanic action setting up more rapid decomposition. In certain cases the adherent graphite coat on an exposed piece of iron mechanically obstructs access of the corrosive agent. As an aggregate the electrolytic propensities of the metal are undesirable, and for success in corrosion resistance, must be combated by other agencies.

This is the fifteenth article of a series on the engineering properties of gray iron. The fourteenth appeared in the March 1 issue, and the sixteenth will appear in an early issue.

THE EDITORS.

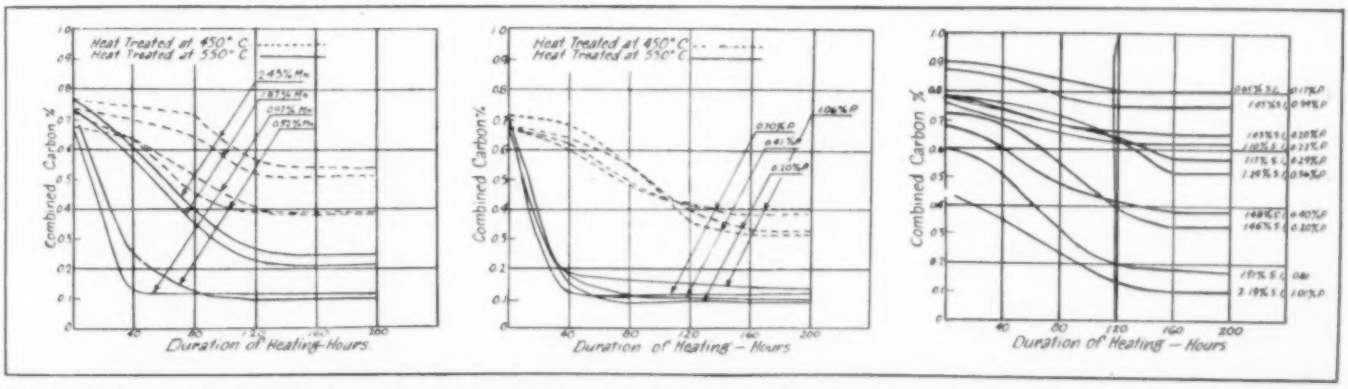

Heat Treated at 450° C
Heat Treated at 550° C
Combined Carbon %
Duration of Heating-Hours
Duration of Heating – Hours
Duration of Heating – Hours

Fig. 101—*Change in Combined Carbon Content in Iron with Varying Manganese Content Due to Heat Treatment. Fig.* 102—*Same for Iron with Varying Phosphorus Content. Fig.* 103—*Change in Combined Carbon in Iron with Varying Silicon Content. Donaldson's Results*

BLENNERHASSETT
ISLAND
Once owned by George Washington.
Here in 1805 Harman Blennerhassett and Aaron Burr planned their conquest of the west.

Fig. 1—A Large Marker Is Erected at Each of the Main Historic Spots and Carries an Individualized Ornament Illustrating the Chronicled Event

Castings Mark Revolutionary Trail in Ohio

MENTION of the Revolutionary war usually brings visions of Concord bridge, the Boston tea party and the "shot heard 'round the world." Casual contact with history leaves the impression that the revolution as an historic attraction and incentive to memorial erection, is the exclusive property of the eastern states. Few, perhaps realize that there were important military campaigns or engagements fought in the Ohio Country. That such engagements had a determining bearing on the establishment or growth of the country is still more remote in the public mind.

The state legislature of Ohio proposes to end all doubt as to the share of revolutionary lore properly belonging to the Buckeye state. Tourists are to be made revolutionary-conscious while passing through Ohio. Accordingly the law makers, at a recent session, passed an act creating the Ohio Revolutionary Memorial commission. The commission later was appointed by the governor, and now is engaged in officially locating and marking the trails or marches through Ohio during the revolutionary period.

Months of careful study and consideration by the commission resulted in the verification of some 20 campaigns or marches in Ohio. The routes have been established and laid down on the improved highways nearest the actual lines of March taken by the soldiers of the revolution. The memorial road marking system, shown in the accompanying illustrations, recently was adopted. Competitive submission of ideas and designs for the marking plan resulted in many proposals, the winning plan being submitted by Sewah Studios, Marietta, O.

The state commission hopes to make Ohio one of the best marked states in the Union, and it is to that end that the plan and construction adopted have been chosen. The directional markers are for road intersections only, while the milage markers inform the traveler not only of the particular line of march he is following, but also of the points of interest he is approaching and the distances to them. At each of the main historic spots a large marker as shown in Fig. 1, will be erected to describe the historic happenings there. Each marker of that type will carry its individualized ornament illustrating that particular location or event so that the traveler can follow easily and read the history along the way.

The markers are of cast of a spinal alloy and finished in polychrome bronze. The raised metal letters are

(Concluded on Page 83)

Fig. 2—Directional Markers Are for Road Intersections Along the Trail

Fig. 3—Distances to Points of Interest Are Shown on Many of the Markers

BILL

By Pat Dwyer

Talks on Reclaiming Core Sand

USUALLY Bill pays little or no attention to the stream of material that flows continually from the radio. Occasionally he takes time out to wonder audibly if any person derives any pleasure from listening to such a bunch of tripe. Now and again he hears a number that meets with his approval. Then he waxes enthusiastic. On the night of the 17th, a decidedly emerald hue permeated the entire program and as a result, Bill lent an attentive and willing ear. He tapped his long feet in time to the lilting instrumental numbers and hummed the melody of most of the songs in unison with the singers. As the program proceeded he waxed bolder and lifted up a ringing baritone in praise of his wild Irish rose. A little later he switched his affections to another lady and announced with great fervor that there's not a colleen sweeter where the river Shannon flows. Many a long year has flown by on whistling pinions and faded into oblivion since Bill left the land of his birth, a little lad in short pants faring forth bravely toward the west, toward the magical land of opportunity. He grew up in an American environment and acquired a typically American viewpoint and an easy facility in the use of the language with its intimate accent, nuances, turns of speech and idioms.

However, even after all these years and particularly in sentimental moments, his tongue slips imperceptibly into the grooves of childhood, faintly reminiscent of curling peat smoke, hawthorn hedges, black birds softly twittering in the twilight and small groups of shawled women exchanging confidences in the subdued, musical and rolling cadences, peculiar to the province of Munster.

He has no more inclination or desire than I of ever going back, but to hear him doing the *Tumble Down Shack in Athlone*, one would imagine that the all consuming desire of his life was to once more walk down "The long lane of white cobbled stone." The heart of a graven image would be touched by his passionate declaration that all he wanted was to "Waunce more lay his head on the wee thrundle bed, in that tumble down sha-a-ack in Althlo-o-one!"

In volume, in timbre, in tonal inflection and in a nice, intimate and caressing touch on some of the vowel sounds, Bill's rendition was superior

Tuning In On Station E-R-I-N

to that of the artist at the microphone. I commented on this fact and asked Bill if he ever had harbored any ambition to go on the air. According to popular gossip, based, I had to admit on items appearing from time to time in the infallible daily press, radio artists are compensated to an extent that would make Croesus, one time big shot of Lydia, bite his nails with envy, in the event —remote I grant you—that modern science could find a way of flashing him the news.

"Well," said Bill, "I'll tell you. I don't know how old Skeezicks would take the news of the big money, but certainly if he was brought back and forced to listen to the everlasting braying of some of these radio birds, he would congratulate himself that he had lived in an earlier and happier age.

"The lads I particularly have in mind, are the announcers. Some are good. They speak in a simple unaffected manner and I listen to them with pleasure, but the majority deliver their parrot message in such an insufferably patronising and high hat mannah—G-r-r-r! I'd like to bite 'em!

"Strange as it may seem, some people appear to like that kind of boloney. It always reminds me of the innocently satirical remark of a little girl I knew once upon a time when I was not so big myself. Her aunt had returned to our little town after a six-month sojourn in Boston. Before the grand adventure she—the aunt —spoke even as you and I, but when she returned she had lost the letter *R* and her *A's* were as broad as Commonwealth avenue. In a pause in the conversation the little niece pipes up in adoration; 'Oh Auntie, go ahead and talk proud some more and show your gold tooth!' "At one time or another," Bill continued. "I have heard the English language spoken in dozens of different ways. Almost every county in England has its distinctive accent. The Highland Scottish dialect differs widely from that of the lowlands. The clipped speech of the Ulster Irish bears little resemblence to that spoken in Munster and, while the difference between the English of Galway and Leinster is not so marked, it is sufficient to differentiate between people from these two sections of the country.

"Even here in the United States we have a wide variation in accents between the inversion of the *R's* and the broad *A* of New England, and the soft Southern drawl which does not recognize the letter *R*.

"I have mingled with people in all sections of the country and have accepted their local accent as a matter of course. It aroused no feeling of irritation or antagonism. It was as much a part of the environment as the streets, the houses, the industries, the hills, valleys, rivers and plains of any given section of the country. In fact in some places, particularly the South, the local accent is as soft and soothing to the ear as the balm of Gilead.

"This affected, high hat, illigitimate mongrel English of the radio announcers sure gets my goat. Talking proud and showing their gold tooth! Har, har!"

"You may be doing these hard working young men a grave injustice," I said. "Since they all talk alike it is only reasonable to assume that they studied in the same school, a small but valiant body of

men determined to lift the common people out of their provincialism and flat manner of speech. Instead of condemning these men out of hand, you should feel grateful for the opportunity they afford you of learning how to speak the English language correctly. Just imagine your embarassment if you found yourself in the company of several important men all talking in highly cultivated accents while you sat tongue tied in a corner. You would be scared stiff and would not dare to open your mouth."

Modern Version of the Ant and the Critic

"Who, me?" Bill inquired indignantly. "Say, kid, you have another guess coming to you. Any old time you see me sitting tongue tied in a corner, it will be because I am not interested in the conversation. Up to the present my manner of speech has induced no sign of any inferior complex. Why should it? I have heard important men talking, hundreds of them. A slight accent in some instances serves to indicate the city or section of the country in which they were brought up, but otherwise their speech was simple and unaffected. Never yet have I heard any really important person talking proud or showing his gold teeth. That distinction remains for the counterfeiters.

"I had an interesting experience along that line not long ago."

"Ah!" I said. "Now we are going to have some of the old Nick Carter stuff. *'Old Bill Among the Counterfeiters, or, Shoving the Queer!'* Tell me my good man—and kindly cut it short—were you on the inside or the outside? In other words, did you run this desperate band of nefarious criminals to earth, or—what is more likely—did they run off with your roll and leave you holding the satchel stuffed with neatly cut packages of the famous brown wrapping paper.

"Well," said Bill, "I'll tell you. There are counterfeiters and counterfeiters, including the birds who think they are funny. Back into your kennel Fido and quit your growling. You are holding up the procession.

"Last fall while passing through a small town I noticed a magnificent new plant on the outskirts. The name prominently displayed, reminded me of a news item I had seen some time before to the effect that an old friend of mine had been appointed manager of this plant. You know me, a sociable kind of a lad. I decided to go in and pay him a visit. He is a good old scout, one of the best and an exceedingly able foundryman. I had every reason to anticipate a pleasant and profitable session. My anticipation was more than realized. A wide and beautiful stairway in the main hall of the office building heavily carpetted and brass rodded indicated to my experienced eye that the office of the president and the offices of other dignitaries were on the second floor. I had not the pleasure of knowing any of these gentlemen. Certainly they did not know me. Barging into a man's office under these conditions is not conducive to cordiality. What is a visit, I ask you, if the good old spirit of cordiality is lacking? Dead sea ashes, my lad, and you can lay to that. I decided to postpone the mutual pleasure until and if a more fortunate occasion presented itself. A door at the right of the main hall marked *Manager* seemed to offer the most promising lead. I entered and found the room occupied by a charming young lady seated at a telephone switchboard, also by a man apparently about 40, who was standing by a large desk.

" 'Hello,' says he, in a perfectly friendly way. 'How are you and what's on *your* mind this fine morning?' I almost thought he knew me.

"I told him I had just dropped in for a minute to pay my respects to my old friend Dick Dunbar—that is not his name, but it will serve—if I told you his real name, you would drag in a lot of inconsequential detail and I never would get this story finished."

"At the rate you are going," I ventured to remark, "you never *will* finish the thing. You remind me of the lad who asked his friend after a political meeting if the speaker of the evening had thrown enough fire into his speech. 'The trouble with the speaker of the evening,' the other lad remarked sourly, 'is that he didn't throw enough of his speech in the fire!' "

"Purry good," Bill admitted handsomely, "Purry good! I must remember that one. It will come in handy some time.

"However, as I was just going to say when you popped up out of your nest, the young lady at the switchboard volunteered the information that Mr. Dunbar was out in the plant some place. If I would be kind enough to give her my name and state the nature of my business, she would try to get in touch with him.

"That's right,' the lad at the desk cuts in, in the most friendly and informal manner. 'Tell the little lady the story of your life. You can rely on her discretion.'

"Putting one thing and another together, the lad's easy informality, his presence in Dick's office, his neglige costume, particularly a floppy hat, and his readiness to engage a stranger in conversation, I jumped to the conclusion that he was Dick's assistant. A little facetiousness, I felt would not be out of place.

They Were Dressy Lads in Them There Days

"Assuming the grand theatrical manner I said, 'Peace, fellow!' Then I wrapped an imaginary cloak across my breast and stalked across to the

switchboard *a la* John Barrymore, setting the heels down hard at each step. I extracted a card from my card case, bowed low and presented the card with a noble flourish and the brief message, 'Permit me. My Cawd!' Then I stepped back one pace, left hand on an imaginary sword hilt and right hand nonchalantly twirling the ends of an imaginary moustache.

"The girl smiled in flattering appreciation of this little bit of nonsense. Then she pluged in a number and I heard her announce my name. Presently she turned and told me that Mr. Dunbar would be in our midst in a few minutes. "'Tis well, lass,' I said. 'You shall never rue the day you befriended a pilgrim and a stranger. Here and now in the presence of witness, to wit, the noble gent crouched over yon desk I do solemnly promise that on my death bed I shall will and bequeath you one of my curls.'

The Gent Is Pleased

"The noble gent aforesaid, laughed at the exhibition and declared by all that was good and holy I was a dead ringer for Jim McCarthy, president of the Tidewater Castings Co., I looked like him, acted like him and had the same tricks and mannerisms of speech, even to the accent.

"Presently, Dick came in and finding us chatting away merrily, assumed that we knew each other and that an introduction was unnecessary.

"We fell into a general conversation and after a while the assistant asked Dick how the burners were working in a certain oven. Dick said they were not quite up to the mark. The lad said he had been thinking it over and he had worked out a better idea which he proceeded to illustrate on a sheet of paper He suggested that Dick should try it out.

"From the manner of his presentation I decided I had sized him up wrong. Evidently he was a salesman or a service man from some company which had installed these burners and simply was a visitor even as I.

"Finally Dick suggested that I should accompany him on a tour of the plant.

"'Go ahead' says the other lad, 'and if he does not tell you all you want to know just come back and ask me!'

"Well," I said, "now that you mention it and just to keep the record straight, I should like to ask you one question. Where do you fit in? Are you an insider or an outsider?"

"Who, me?" said he with a quizzical grin, "Hell, I just own the joint that's all!'

"I nearly collapsed. Dick naturally was embarrassed, but as he explained, finding us in friendly conversation he had assumed we knew each other. The other man, president and principal owner of a $2,000,000 corporation seemed to think the whole thing an amusing and capital joke on me.

"Out in the plant I found part of the answer to an inquiry sent me some time before by a man who wrote that his company was considering the problem of salvaging the core sand after it has been knocked out of the castings. He also wanted information on any economical method for salvaging and straightening core wires.

"Boiled down to its essentials, the problem of salvaging core sand, depends on the relative cost of the reclaimed sand, that is the cost of this sand as compared with the cost of new sand. So far as actual reclamation is concerned the work may be carried on quite readily, but it simply is love's labor lost if it does not cut down the operating cost of the core room.

"No broad general statement can be laid down to govern the most economical method of reclaiming core sand or in what proportion the reclaimed sand should be used in the ensuing core sand mixtures. Each foundry constitutes an individual problem in this respect and the problem must be solved by the man on the job who is familiar with all details and conditions.

"Where the cores have to meet certain highly exacting standards, the addition of reclaimed sand to the mixture has not always been satisfactory. Possibly this has been due in some instances to the condition of the reclaimed sand. Even in light castings, a certain part of the core is burned to the extent that the grains of sand are disrupted and reduced to powder. On larger and heavier castings the proportion of sand rendered unfit for further use, is correspondingly greater.

Use Two Methods

"Where some method is employed to remove the dust—usually referred to as *fines*—the sand should work as satisfactorily as new sand. Two principal methods are employed for this purpose. In the first the sand is subjected to the action of a flowing stream of water which carries away the fines and leaves the larger grains. In the second method the sand is exposed while in motion to an air blast which serves the same purpose. Naturally, any installation of equipment for carrying on the work by either method must be of individual design in many respects.

"Where he has had former experience along the line of reclamation, the shop superintendent or master mechanic may be qualified to design a workable system, but as a general rule the job is entrusted more safely to foundry engineering firms who have specialized in the design, manufacture and installation of sand handling equipment of all descriptions for many years.

"The foregoing refers specifically to the reclamation and cleansing of spent core sand so that it compares favorably with new sand and may be used either alone or in combination with new sand to form cores. I presume that he is familiar with the fact that this type of sand is absolutely essential to the production of certain types of castings.

"However, in a great number of other instances old sand may be, and is added, to the core sand mixtures in varying proportions from 5 to 95 per cent with perfectly satisfactory results. In some instances no particular preparation is necessary. The spent core sand in bulk or in lumps is thrown into the mixing device with the other ingredients.

"One peculiar feature to be noted where spent core sand is added to the mixture is that the amount of binder also must be increased. This only applies to spent sand that has not been cleaned and probably is due to two causes: The fines prevent a proper penetration of the binding agent and, the carbonized surface of the grains do not unite as readily as clean surfaces with the binder.

"Briefly it may be stated that old core sand may be employed freely and without any special preparation in cores where extreme permeability is not the main desideratum. If spent sand is to be added to core mixtures for cores that are surrounded almost entirely by molten metal, the spent sand must be restored to its original condition before it is added.

"Wire straightening machines are in use in the core rooms of all the automobile foundries.

Chain Belt Co. Changes Office Managers

Changes have been made in the personnel of the Cleveland, Buffalo, St. Louis, Portland, Ore., and Seattle, Wash. offices of the Chain Belt Co., Milwaukee. Mr. Smallshaw, formerly in charge of the St. Louis office has been transferred to Cleveland. Thomas Cocker, formerly manager of the Cleveland office will be in charge at Buffalo. Frank Gary has been transferred from Buffalo to St. Louis, Hy Bergis from Seattle to the Portland, Ore., office and Gerald Nichols will go from the Portland office to take charge at Seattle.

Stacey Engineering Co., Columbus, O., of which the Connersville Blower Co. Inc., Connersville, Ind., P. H. & F. M. Roots Co., Connersville, Ind., Wilbraham-Green Blower Co., Pottstown, Pa., and Stacey Bros. Gas Construction Co., Cincinnati, are subsidiaries, has opened a branch office at 235 Montgomery street, Russ building, San Francisco. E. A. McCallum has been appointed district manager and will have charge of the office.

Teach Foundry Practice Course at Night Classes

By M. J. Shogren and Jack Davis

APPRENTICE training has held the attention of foundrymen for many years. Foundrymen aware of the dearth of experienced molders, patternmakers, coremakers, etc., and have turned to the apprenticeship method of fulfilling that need. Many foundries have organized systems and have reaped the benefit of their endeavors. Milwaukee is one of the strongholds of apprenticeship and one of the leading foundry centers of the counry. West Allis, a neighboring city of 35,000 people, which usually is included in an industrial survey of Milwaukee, is another firm believer in apprenticeship. That is especially true of foundries in that locality.

However, in recent years it has been realized that men already employed form a source of supply for executives providing they were schooled in the theoretical side of industry. Those men already had the practical side in certain divisions of industry and with instruction in other branches could be developed into valuable employes. The Vocational school of West Allis, realizing that many men of that class were unable to attend day school, organized night classes for those interested in learning more about their respective trades. The classes are open to any citizen of West Allis who will attend regularly and study.

First Class Organized

At the beginning of a recent term of night school, a class for foundrymen was organized for the first time. This class was an experiment, but proved that foundrymen are interested in learning more about their trade. Men enrolled in the course were picked from the more ambitious foundry employes, and included molders, apprentices, and minor executives. It was found that a large number of foundrymen wished to take up vocational school work, but could obtain no subjects fitted to their particular trade from among standard courses offered at night school. Therefore, it was necessary to organize a course to fit the particular needs of this group of men.

Since the material offered was new and untried, care was taken at the beginning to encourage the enrollment only of those students whose interest was more than a temporary enthusiasm and to discourage the few who would be unable to hold an interest in the course. Even with those restrictions the enrollment was large enough to require two classes to insure individual attention to every student. Classes were of 1 hour and 45 minutes duration, beginning at 7:30 p.m., two nights each week, one class meeting on Tuesday and the other on Thursday.

It was found that one evening each week was ample time for the presentation of enough subject matter for a molder to conveniently digest between meetings. It is difficult enough to study after a hard day's work as a molder, and so more than one session each week for each group, in addition to the necessary home study to keep up with the class, would become tiresome before the end of the term.

Explains Foundry Theory

No attempt was made to teach the men the actual making of molds and cores. The principal purpose of the course was to teach those parts of foundry theory and practice which the molder could not easily acquire in his everyday work. A number of the students were expert molders, interested in advancing themselves to better positions, Therefore, the subject matter presented was selected with the purpose of helping those men gain knowledge which would be of use to them later as foundry foremen and also from which they would derive a direct benefit in their everyday work. The subject matter included such topics as history of iron, blast furnace practice, cupola melting, care and operation of melting equipment, melting action in the cupola, temperature, analysis of iron, mixing iron by analysis, study of molding sand, synthetic sand, and sand control.

Since no text book could be found that would present the work in a desired form and sequence, material was prepared by collecting information from various sources and presenting it to the class in the form of mimeographed sheets.

Sequence of the various units was considered carefully with a view to holding the interest of the student. It was determined that a study of the cupola was the most interesting subject, and so it was placed first on the list of topics. A short preliminary lesson first was given on the manufacture of various types of pig iron to familiarize the student with sources of iron and blast furnace operation. Mixing of iron by analysis is always of interest to a modern foundryman and it was chosen as the second course of lessons. That topic was followed by a study of sand, the last of the three principal units taken up in the limited time.

Various Methods Used

The work was presented in various ways to prevent the subject matter from becoming monotonous. Usually each night's lesson was begun by a lecture, well illustrated by large black-board drawings, cross sectional views, samples of iron, sand, or whatever material could be obtained. Mimeograph sheets were used to supplement talks and to stimulate class discussion. As a final check on each lesson and to determine the ability of a student to dig out information for himself, objective tests were used. The results obtained from these tests proved their value in the first lesson. Therefore, they were continued throughout the course.

Objective tests were of several types and included statements in which the student was required to distinguish between those which were true and those which were false. Another test in which missing words were inserted by the students in blanks in the sentences. That method served as an excellent check upon what the student had learned from a lecture, demonstration, or discussion. Illustrative material was presented in various forms, dependent upon the topic being studied.

Whenever students were given the opportunity to observe sand or iron under the microscope, a surprising amount of interest was shown, the men having regarded such materials

as common. They learned that there is something wonderful and attractive about their daily routine work, not always seen by looking at iron or by gazing at a pile of sand.

Every possible opportunity of presenting illustrative material was ore. A large cross-sectional drawing of the various parts of cupola, accompanied by several detailed drawings, was used to present various phases of cupola operation, such as height of bed, proper location of melting zone, slope of sand bottom, location and proper shape of tuyeres, order of charging, and various other details.

Some time was spent on the influence of the various elements in cast iron, use being made of the microscope and other laboratory equipment. Test samples of a known analysis were examined and their characteristics noted.

After the students had learned something of the influence of each of the various elements found in iron, they were ready to study metal mixtures. For that purpose, actual analyses of pig iron and scrap from foundries where the men were employed were used to calculate mixtures for the castings which the students had had a part in making.

The study of sand developed considerable interest. Grain size was shown by screening sand through various size screens and placing a sample of what passed through each screen upon a piece of freshly shellaced paper. Grain shape was best shown by a microscopic study. Difference between round, angular, and subangular grains was shown clearly in that way.

In view of the results obtained, the cost of the course was insignificant. The expense to each student was one dollar for the term, with all material and instruction supplied.

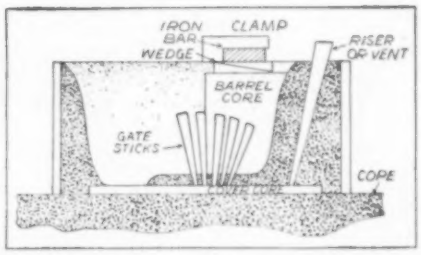


Fig. 3—Pouring Basin Showing Gate Sticks in Position

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under This Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Casts Large Bushings

TO THE EDITORS:

In the Jan. 15 issue of THE FOUNDRY under the head "Sulphur Gases Brass," information is given relating to the manufacture of brass bushings. The casting of that type of bushings is a big problem to many foundrymen. I never have read a description of that operation in which the castings are gated as we gate them at the foundry with which I am connected. We cast bushings and plungers from 18 inches to 12 feet long and secure perfect castings from either iron or brass.

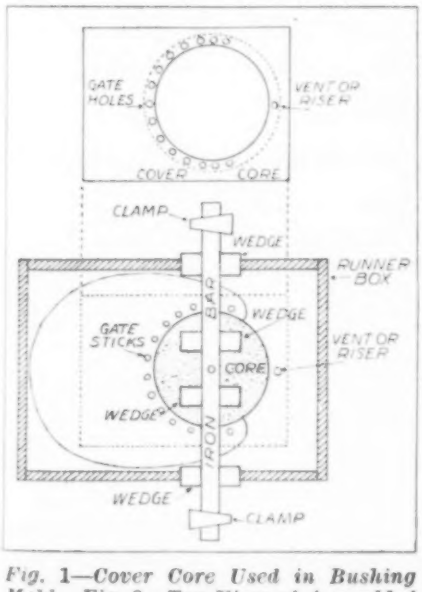


Fig. 1—Cover Core Used in Bushing Mold. Fig. 2—Top View of Assembled Bushing Mold

The mold is rammed in the usual manner, except that the gate stick is discarded. The mold is finished and the core, which is approximately 10 inches longer than the casting is set. In place of the usual type gate, we use a rectangular, white sand, cover core, 1 to 1½ inches thick, from which a portion is sawed so that the core just will slide over the bushing core, as shown in Fig. 2. The cover core is shown in Fig. 1. Holes are drilled about two thirds the distance around the core. For large bushings, the holes should be at least ¾-inch in diameter about 1½ to 2 inches apart and about 12 to 15 in number. If the hole in the cover core, which fits over the bushing core, is too large or is out of shape, the excess space is filled with cotton waste.

After the cover core has been fitted properly, make the same number of gate sticks as there are holes in the core. Those sticks should be tapered and are placed in the cover core holes. Place an empty runner box or cope on the mold and fill it with sand. Ram with the shovel handle, being careful not to strike the gate sticks. Cut out the sand in the box with a trowel to form a pouring basin, as shown in Fig. 3, and remove the gate sticks carefully to prevent sand from falling into the mold. Place an iron strip across the runner box so that the strip bears on the box and put a clamp on each end, as shown in Fig. 2. Wedges then are set under the strip and over the core. If hot metal is used, no castings should be lost with that method of gating. However, when large bushings are gated on the bottom and part way up the side, the foundryman is inviting trouble because the metal climbs the side of the mold so slowly that is lays dead and bubbles.

In making small bushings, I gate them as advised in the article but omit the top gate. The gate on top always causes a shrink under it. I pour all bushings up to 12 inches long in that manner but all over that size I use the cover core method. I find it best to gate small bushings and rings on the bottom and half way up and run a number of vents up through the cope to leave the steam and gas out quickly so that the core will not be moistened. Heavy bushings up to 12 inches long with green sand cores do not require a middle gate. However, they should be vented through the cope with a ¼-inch vent rod. Such castings should be molded in a three-part flask so that the mold may be blackleaded and gated properly. The cope should not be less than 6 inches deep. When pouring that type castings, keep the sprue full and use hot metal.

I mold bushings up to 3½ inches in diameter in 12 x 18 inch iron flasks and gate them as shown in Fig. 4. Molders have trouble with bushings because they core their molds as they finish them. If that is done, the blacking on the core becomes pasty and the metal will not lay on it no matter how open the sand is. The required number of molds should be made and left open. When the molds all are made,

(*Concluded on Page* 83)

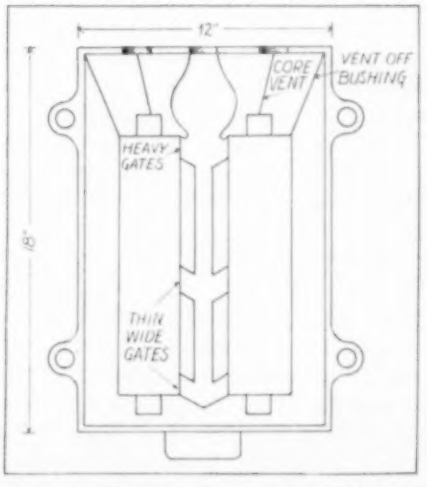


Fig. 4—Method of Gating 3½-inch Diameter Bushing Castings

The Shakeout

DAN M. AVEY, *Editor*
FRANK G. STEINEBACH, *Managing Editor*
PAT DWYER, *Engineering Editor*
EDWIN BREMER, *Metallurgical Editor*
CHARLES VICKERS, *Nonferrous Editor*
NORMAN F. HINDLE, *Assistant Editor*

¶ This Rackety Age

A NEW YORK salesman was swinging briskly along lower Broadway, with his mind on his next prospective call, when a plausible, but shabby stranger dropped into step alongside, and inquired; "Yu don't wanta buy a good watch do yu?" Just another racket. The implication that the salesman might be a prospect for a piece of stolen or contraband jewelry might have met with more ready acceptance, if it had not been for his familiarity with the smuggled-fur game, and others of the type pulled by shady individuals in sailor garb.

THE meanest type of racketeer is preying on those unfortunate victims of industrial conditions, the unemployed who are in dire need of a job. Hanging around outside the employment offices in the large cities, these furtive weasels promise to get a job seeker a position, on payment of a dollar or two. The addresses which the victims receive many times are fictitious or lead to establishments with which the racketeer has not even an acquaintance. Others, by devious means seek to make connections by mail or advertisement, though publications are wary of such ads, with men out of employment, to solicit registration or service fees from unemployed. Payment for actual service in securing employment is justified, but beware the pay-as-you-enter individual or organization, that promises choice jobs these days.

¶ Cluttered Up with Diamonds

A RECENT letter from the purchasing agent of a manufacturing concern requested the cancellation of a foreman's subscription to a well known publication. His reason? The foreman insisted on keeping all the back copies piled on his desk for reference and the accumulation was unsightly and distasteful to the management.

NOW modesty forbids mention of the name of the publication. Suffice it to say that the foreman was in charge of a foundry, and the magazine which he saved for reference is the only one devoted exclusively to the foundry industry. Furthermore, active and progressive foundrymen have a habit of saving back copies, since they seek ready access to information on casting practice. They like to turn again to the advertising pages which reflect the advancement in machines and materials that foundrymen use in their business.

THE publishers, editorial, circulation and advertising staffs of that modest publication thank the writer of the letter and condole the lost subscriber. No doubt the misguided watcher of the company treasury will light a Murad and nonchalantly request the office boy to put another scuttle of banknotes into the office stove.

¶ Investigate Price Shavers

AN ENERGETIC secretary of a foundry organization has uncovered an interesting fact. Under the stress of business depression, the bargain buyer who places castings orders on price alone is thriving. Any encouragement which might be necessary to promote price cutting is particularly prevalent in times like these. Consequently, the close buyer in shopping about seeking to shave a fractional cent per pound from the price of castings is having his day.

THIS fact, developed by the association executive, is worthy of consideration. A few foundries, by comparing notes, have found that the most notorious of these bargain seekers are those whose credit rating is open to question. In other words, instances are given of firms that have been buying castings from certain foundries and have been rather slow in paying for these castings. These customers are the first to shop around and endeavor to secure cut prices from other castings manufacturers. When asked to cut a price, investigate the credit of the inquirer.

¶ Standardization and Castings

PROGRESS toward standardization in various fields of industry is emphasized in the *Standards Yearbook*, recently published by the department of commerce. It is interesting to note, that while only a relatively few activities of interested bodies relate directly to the foundry industry, perhaps a majority of the programs indirectly affect the industry through standardization of products in which castings play an important part. Among the direct foundry problems mentioned in connection with standardization work are the following: Foundry apprentices, malleable refractories, materials and methods, patterns of wood, shrinkage of metals and chilled car wheels.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

A. F. STEEN, furnace engineer in charge of heat treatment equipment in the tractor works, International Harvester Co., Chicago, for more than eight years, has become affiliated with Chicago Steel Foundry Co., Chicago, manufacturer of heat and abrasion resisting alloys. He will have charge of the service department, furnace engineering.

J. W. Root has been appointed sales manager of Ben Sibbitt Iron & Foundry Co., Wichita, Kans.

Thomas Holloway, formerly identified with the Farrell Foundry & Machine Co., Buffalo, has joined the United Engineering & Foundry Co., Pittsburgh, as gear consultant.

Lewis T. Briggs has retired from active association with Erie Bronze Corp., Erie, Pa., resigning as vice president and disposing of his interest to **Bert C. Edkin,** who continues as president.

Dr. Bradley Stoughton, professor of metallurgy, Lehigh university, Bethlehem, Pa., has been appointed consulting metallurgist for the Standard Steel Works Co., Burnham, Pa.

Walter J. Hansen, sales engineer, for the past 9 years associated with Electroalloys Co., Elyria, O., now will represent the Chicago Steel Foundry Co. Chicago, at Syracuse, N. Y., in the sale of its alloys.

B. J. Larkin, recently connected with the J. I. Case Plow Works Inc., Racine, Wis., has been appointed manager of the Algoma Foundry & Machine Co., Algoma, Wis.

H. E. Bromer, metallurgist, Standard Foundry Co., Racine, Wis., was guest speaker at the March dinner meeting of the Milwaukee section, Society of Automotive Engineers. He spoke on "Electric Furnace Iron and What It Means to the Automotive Engineer."

J. F. Griswold has been named to succeed **W. C. Davis** as president and a member of the board of Foote Bros. Gear & Machine Co., Chicago. **A. B. Wilder** also has been named a member of the board. Other new officers chosen by directors are: Vice president, **F. A. Emmons;** secretary and treasurer, **A. L. Gray;** assistant treasurer, **J. R. Fagan;** and assistant secretary, **O. R. Moss. W. A. Barr** and **H. A. Bates** were re-elected vice presidents.

Lewis A. Way, formerly vice president in charge of sales, Pittsburgh Steel Foundry Corp., Pittsburgh, now a division of the Continental Roll & Steel Foundry Co., has been appointed manager of production and sales in the roll department of the Elwood City, Pa., plant of Aetna-Standard Engineering Co., Youngstown, and Warren, O. Prior to his Pittsburgh Steel Foundry connection, Mr. Way was president of the Sharon Foundry Co., Sharon, Pa.

William E. Hall recently was elected president of the Duriron Co., Dayton, O., at a meeting of the board of directors held in New York. He succeeds P. D. Schenck, late president and founder of the company. Other officers elected include **Dudley H. Miller,** St. Marys, Pa., vice president; **John R. Pitman,** New York, vice president; **Robert C. Schenck,** Dayton, secretary; and **E. B. Thacker,** Dayton, treasurer.

Pittsburgh Foundrymen Hear Talks on Power

Representatives of the Philadelphia Co., Pittsburgh, public utility company, discussed the use of gas and electric power in the foundry industry before the monthly meeting of the Pittsburgh Foundrymen's association, held March 16. About 40 members were present. F. A. Kolb spoke on "The Mutual Interests of the Foundry and Electric Utility," pointing out methods for the most economic use of electric power in the foundry. "Modern Lighting in the Foundry" was discussed by W. S. Redpath. Illustrations showed good and bad lighting arrangements in various industrial plants, and recommendations were made for the most efficient illumination of different foundry departments. Best practice in use of natural gas as a foundry fuel was described in a paper presented by J. P. Brosius.

Groups Unite To Hold Industrial Congress

The second National Industrial congress and exhibition will be held in the Public Auditorium, Cleveland, April 13 to 17 inclusive, under the auspices of the Society of Industrial Engineers, elimination of waste committee, the Cleveland Engineering society, Cleveland Electrical Maintenance Engineers association, materials handling, management and maintenance divisions of the American Society of Mechanical Engineers, and the American Management association. Papers presented at the convention will cover management, maintenance and material handling.

Among the papers to be presented are: "Briquetting of Cast Iron Borings and Steel Turnings," by A. K. Nowak, Baldwin Southwark Co., Chicago; "Monorail Handling of Materials," C. W. Preston, Majestic Household Utilities Co., Chicago; "Engineering Factors in the Use of Electric Hoists," by H. J. Fuller, engineer, New York; "Distribution and Marketing," by Gorton James, vice president, Thompson & Lichtner Co. Inc., Boston; "Use of Gas trucks and Tractors in Materials Handling," by George E. Hagemann, editor, Alexander Hamilton institute, New York; and "Handling Bulk Materials Mechanically," by W. W. Sayers, Link Belt Co., Chicago.

Other features include a talk by Dr. Lillian Gilbreth, president, Gilbreth Inc., New York, who will address one of the management sessions on "Skills and Satisfaction" and a banquet scheduled for the evening of April 16 at which Gen. J. G. Harbord, president, Radio Corp. of America, will be the principal speaker.

International Congress Will Be in Paris

Paris, France will be the scene of the fourth international foundrymen's congress which by arrangement of the Association Technique de Fonderie de France will be held September 14 to 20, 1932. The sessions of the congress will take place at the Ecole Nationale d'Arts et Metiers, 151, Boulevard de l'Hopital, Paris. An international foundry exhibition will be held from September 12 to 27, 1932, at the Parc des Expositions, Port of Versailles, Paris. Numerous visits to foundries and metallurgical works in the Paris district will be made and a tour through the industrial region of France is planned.

The French committee which has charge of preliminary arrangements is anxious that a representative party of American foundrymen shall attend this congress and exhibition, recalling the hospitality extended to French foundrymen on occasion of the second international congress held in Detroit in 1926.

G. E. Madden, formerly with the Union Steel Casting Co., Pittsburgh, has become affiliated with the Industrial Silica Corp., Youngstown, O. Mr. Madden will represent the Industrial company in the Eastern section of the United States.

OBITUARY

Harwood Byrnes, vice president, Aluminum Co. of America, died March 7 in New York.

Harry P. Readmon, 53, for the past 12 years purchasing agent, Chicago Pneumatic Tool Co., New York, died Feb. 26.

Phillip S. Manley, 59 years old, identified with Buckeye Steel Castings Co., Columbus, O., for 13 years, died March 6. He had charge of the gas manufacturing department.

Frederick C. Laass, 69, patternmaker for 19 years at the Crouse-Hinds Co., Syracuse, N. Y., died recently. He was born in Germany and came to America 50 years ago.

David A. Ebinger, 75 years old, president, treasurer and founder, D. A. Ebinger Sanitary Mfg. Co., Columbus, O., died recently at Fort Myers, Fla. He was president of Columbus Heating & Ventilating Co., Columbus, until 1910 when he resigned to form the D. A. Ebinger Sanitary Mfg. Co.

John R. Mulcare, Buffalo district manager, American Car & Foundry Co., New York, for the past 10 years, died March 13, following an illness of 6 weeks. He was 58 years old. Prior to his Buffalo service, Mr. Mulcare was an estimator for the Pressed Steel Car Co., Pittsburgh.

Frank J. McKernan, foundry superintendent, J. H. Day Co., Cincinnati, died recently at his home in Cincinnati following a short illness. Mr. McKernan was born in Cincinnati 56 years ago and prior to his connection with the Day company was one of the proprietors of the Vulcan Foundry Co., Cincinnati. He had been with the Day company for the past 20 years as foundry superintendent.

Henry B. Utely, 76, vice-president and director, International Harvester Co., Chicago, until his retirement in 1930, died recently at Beverly Hills, Calif. As a young man he became associated with his uncle, the late E. K. Butler, in the Keystone Implement Co., Rock Falls, Ill. When the Keystone company was acquired by the International Harvester Co., he became a superintendent. In 1907 he was made manager of the purchasing department of the parent company at Chicago. He had served as vice-president since 1919.

Howard C. Woglom, 57 years old, who retired in 1926 as plant manager, Taylor & Fenn Co., Hartford, Conn., having served in that capacity for 8 years, died March 7. At the age of 16, he was employed by Brown & Sharpe Mfg. Co., Providence, R. I. In his eary twenties, he located in Hartford, becoming associated with Pope Mfg. Co., and other manufacturers. For 17 years he was with Pratt & Whitney Co., rising from draftsman to superintendent. He resigned during the World war to enter governmental service and later became connected with Colt's

DIRECTORY OF FOUNDRY ASSOCIATIONS

American Foundrymen's Association

President, N. K. B. Patch, Lumen Bearing Co., Buffalo; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago. Annual meeting, Stevens hotel, Chicago, May 4-7, 1931.

Associated Brass Founders of New England

President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, Herbert H. Klein, Pennsylvania Foundry Supply Co., 310 Congress street, Boston. Meetings the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Connecticut Nonferrous Foundrymen's Association

President, C. H. Blanchard, Reading Steel Casting Co., Pratt & Cady division, Hartford, Conn.; secretary, C. D. Elliott, Wilcox, Crittenden Co. Inc., Middletown, Conn. Meetings held the second Monday of each month at place to be named. Recent meetings have been held at Hotel Garde, New Haven, Conn.

Detroit Foundrymen's Association

President, James L. Mahon, American Car & Foundry Co.; secretary, William J. Muhlitner, Great Lakes Foundry Sand Co., 2100 Penobscot building, Detroit. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association

Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. Bull, Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, B. H. Johnson, Florence Pipe Foundry & Machine Co., Florence, N. J.; manager, Arthur J. Tuscany, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill.; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting date, May 27.

New England Foundrymen's Association

President, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month excepting July and August at the Engineers club, 2 Commonwealth avenue, Boston. Outings usually are held in the months mentioned.

Ohio Foundries Association Inc.

President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland.

Pacific Coast Founders Association

President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. Truitt, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, C. F. Hopkins, Ajax Metal Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, W. E. Troutman, Duquesne Steel Foundry Co., Pittsburgh; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, R. L. Eichman, Bettendorf Co., Bettendorf, Ia.; secretary-treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, Horace R. Culling, Carondelet Foundry Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association

President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa.; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, William Hoppenjanz, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, William J. Snyker, St. Paul Foundry Co., St. Paul; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. P. Jensen, Prescott Co., 1 West Lander street, Seattle; secretary, Edward C. Gustin, 3716 Grayson street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group

Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

Patent Fire Arms Co., becoming closely associated with M. W. Hanson, vice president, as works manager. He next went with Taylor & Fenn Co.

Francis O. Hitchins, 65, vice president, Headford Bros. & Hitchins Foundry Co., Waterloo, Iowa, died recently. Mr. Hitchins began his career as a foundryman soon after graduation from the public schools in Dubuque, Iowa, when he became affiliated with the Iowa Iron Works of that city. In 1892, he became associated with the Headford Bros. plant then located in Dubuque and the name of the company was changed to the present one. He was elected vice president in charge of production, a position he held for 39 years until his death. Headford Bros. & Hitchins Foundry Co. moved to Waterloo in 1903 and built a foundry on Westfield avenue.

Alfred Bishton Botfield, founder of the Botfield Refractories Co., Philadelphia, died recently in Miami, Fla. at the age of 83. Mr. Botfield was born Sept. 20, 1847 in Shifnal, Shropshire, England and received his early education in the schools and universities there. Originally a manufacturing jeweler in England, he spent many years traveling in South America, Cuba and the United States. In 1899, Mr. Botfield acquired a controlling interest in a marine construction and repair enterprise in Havana. Later he came to the United States and established the Botfield Furnace Specialties Co., Philadelphia. In the early part of this century, he began experiments which finally led to the development of a high temperature cement.

Daniel J. Kilby, associated with the Kilby Mfg. Co., Cleveland, since its inception in 1888, died in the Lutheran hospital, that city, March 17 after a brief illness, at the age of 60. The late Mr. Kilby was born in Sandusky, O., where his father was a partner in the firm of Barney & Kilby. When his father moved to Cleveland to take over and reorganize the Prospect Machine & Engine Co., a successor to the Cummer Engine Co., Mr. Kilby Jr. came with him and in turn assumed various positions on the executive staff. As sales manager he was widely known particularly in the sugar industry. For many years the Kilby Mfg. Co. has specialized in the manufacture of sugar mill machinery and has set up installations in this and foreign countries. He was a director of the Kilby Mfg. Co., president of the Community bank, Lakewood, O., before it was consolidated with the Lorain Street Savings & Trust Co., Cleveland, member of the chamber of commerce and the Cleveland Athletic club. He is survived by a widow, Emma J. Kilby, one brother, Herbert, and an adopted son, Harry Robert, all in the city of Cleveland.

Quad-City Group Hears Talk on Malleable

E. E. Griest, Chicago Railway Equipment Co., Chicago, addressed the largest meeting of the Quad-City Foundrymen's association ever held, with 148 present, on March 16 at the John Deere Athletic club, East Moline, Ill. Mr. Griest spoke on "New Developments in the Malleable Iron Industry."

In outlining the history of that industry, Mr. Griest described the founding and told of the progress that has been made to date. According to the speaker, great changes have been made in the production of the malleable castings. Early production methods were fraught with many struggles to maintain quality with little or no knowledge of past experience and an extremely small amount of technical control.

At various times methods have been introduced to reduce the amount of physical labor involved in the process. Today both powdered fuel and oil are used successfully. Core room practice; sand handling, control, and preparation; and cleaning methods have kept pace with the developments of other branches of the foundry industry.

Annealing now is claiming the attention of the malleable producers according to the speaker. Efforts have been made to lower the annealing time with a corresponding increase in quality. While some progress has been made in that direction, thus far annealing time has not been reduced materially. One notable exception is a foundry that is annealing its malleable castings in 25 hours. A lively discussion followed the conclusion of the talk.

Reader's Comment

(*Concluded from Page* 79)

set the cores that are thoroughly dry and warm and pour immediately. When that method of molding is used precautions should be taken to see that the metal is ready at the same time that the molds are so that neither the molds nor the metal have to wait.

I also noticed the foundryman says he uses scrap metal. It is hard to tell what scrap metal contains. If there is any manganese bronze in the scrap, trouble is sure to result because of the aluminum contained in that alloy. Although scrap may be used for some work, I find it best to use ingot metal for bushings. I would suggest an alloy composed 84 per cent copper, 8 per cent tin and 8 per cent lead, poured at 2000 degrees Fahr. During the pouring process, the basin should be filled to the top with the first *dash* of bronze and then should be kept full until the mold is poured. Have a man watch the riser and signal when he sees the metal come to the riser. At that point, pouring should stop and the mold then should be fed gently.

If *bearing* metal is used, in pouring small bushings up to 3½ inches diameter, pour at about 1900 degrees Fahr. Red brass should be poured at a slightly higher temperature. If phosphor-copper is used, raise the metal to the proper temperature before adding the alloy. The phosphor-copper does not make the metal hotter but more liquid. It makes the castings more dense or close grained.

CONRAD W. MILLER
531 *Green Ridge street,*
Scranton, Pa.

Safety Congress Plans Foundry Session

The fourth annual All Ohio Safety congress will be held April 21, 22 and 23 at Columbus, O. In addition to the general sessions on the three days, sectional meetings will be held. John W. Beall, compensation insurance, safety and welfare director, Ohio Steel Foundry Co., Lima, O., is chairman of the foundry section of the congress, which will meet April 22. Three addresses are scheduled. Charles Boultman, manager supply division, Pangborn Corp., Hagerstown, Md., will present a paper entitled "Dust Prevention and Suppression in Sandblasting"; W. T. Cameron, American Optical Co., Cleveland, will talk on "Eye Hazards in Foundries"; and Robert Hoierman, secretary, Ohio Foundries Association Inc., Penton building, Cleveland, will discuss "The Need of Safety in the Small Plant."

Revolutionary Trails in Ohio Marked

(*Concluded from Page* 74)

finished in gold. Each marker is mounted on one or more posts of reinforced concrete of dignified and ornamental design. The markers will be erected by the Ohio State Highway department and will tell the historical importance of over 20 expeditions which marched northward from the Ohio river toward Detroit.

The erection of historic memorial markers which add to the beauty of the nation's highways and bring points of local, historic interest to the attention of the visitor, is a practice which is being followed in a number of states. In Virginia, approximately 700 road-makers, similar to those proposed for Ohio, have been erected as outlined in THE FOUNDRY, April 15, 1930.

The Ohio Revolutionary Memorial commission is composed of nine members serving without compensation. The officers are: A. D. Hosterman, Springfield, O., chairman; Miles S. Kuhns, Dayton, O., vice chairman; C. B. Galbreath, Columbus, O., secretary.

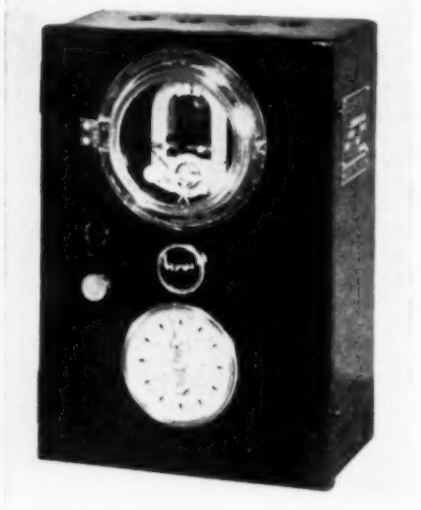
Either Push Button or Pendant Rope Control Are Supplied

Electric Hoist Is of High Speed Type

Wright Mfg. Co., Bridgeport, Conn., has developed a new type electric hoist for high operating speeds. The motors used are of a liberal size and especially built for that hoist. The machine is simply constructed and the shafts are alloy steel. Gears and pinions are heat treated and a special type cable is used. The hoists are designed for different types of suspensions and are supplied with either push button or pendant rope control. Motors and controls are fully enclosed. They are dust-proof and waterproof so that the hoists may be for both indoor and outdoor installations.

Cutout Keeps Furnace from Overheating

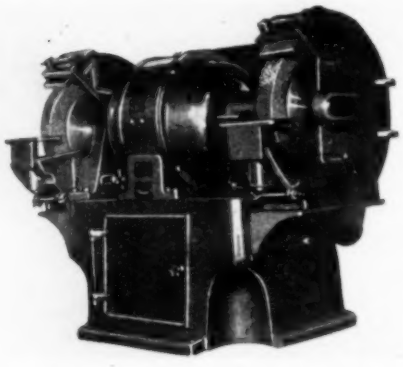
Hevi Duty Electric Co., Milwaukee, has developed an automatic excess temperature cutout which can be applied to any type of furnace to guard the work or furnace from damage due to overheating. The instrument, shown in the accompanying illustration, responds to a thermocouple located in the furnace chamber which, through a thermal cutout, actuates a relay which is part of the furnace control system. Adjustable controls are provided so that the instrument may be set for any desired temperature. It may be calibrated for any thermocouple and used for protection purposes in connection with temperatures up to 3000 degrees Fahr. When the relay is actuated, the source of heat is cut off and a light or an alarm bell is turned on to attract the attention of the operator.



Instrument Responds to a Thermocouple Located in the Furnace

Automatic Speed Control Features Grinder

Black & Decker Mfg. Co., Towson, Md., recently introduced a 24-inch stand grinder equipped with an automatic speed control. The device will maintain a speed of 6000 or 9000 surface feet per minute as desired. The speed control mechanism consists of a rheostat link connected to the guard. As the guard is moved forward to follow the wheel wear, the speed of the motor is advanced automatically.



Speed Is Controlled by Movement of the Guard as the Wheel Wears

A tool rest and automatic spark lip are supplied with the machine and are mounted on the guard so that it is necessary for the operator to adjust the tool rest as the wheel wears. The grinder is equipped with an extra heavy duty motor which is capable of 100 per cent momentary overload. The motor is built for continuous operation.

Metallographic Polishing Machine Is Automatic

A machine for polishing metallographic specimens has been introduced by the American Instrument Co. Inc., 774 Girard street, northwest Washington. It is claimed that the machine produces an extremely high polish, free from scratches and pitting.

The apparatus consists of a polishing head covered with a suitable polishing cloth. The head is mounted on a vertical spindle driven by a belt from a motor located below the polishing mechanism, as shown in the accompanying illustration. The apparatus is equipped with three specimen holders that may be used to polish the same number of specimens in one operation. The holders float on the polishing cloth and change their positions slightly as the contour of the cloth changes. The specimens are held tightly against the cloth by spring rods which bear on the specimen holders.

A rigidly attached gear is located at the top of each specimen spindle. That gear meshes with an eccentric gear which gives the motion to the specimen. The eccentric gear is driven through a speed reducer and as it rotates the three specimen holder gears also turn not only on their own axes but continually oscillate toward and away from the center of the polishing disk. The specimen is free to move vertically within limits and rotates on its own axis. It also is moved from the outer edge to the center of the polishing disk. Quick polishing is claimed to result.

Stockland Equipment Sales Co., 2628 University avenue, southeast Minneapolis, has been appointed agent for the shovel and crane division, Link-Belt Co., Chicago, in Minnesota, excepting a few counties in the vicinity of Duluth, and part of central west Wisconsin. The Stockland company maintains permanent representatives in Thief River Falls, Marshall, Brainerd and St. Paul, Minn., and Barren, Mauston and Eau Claire, Wis.

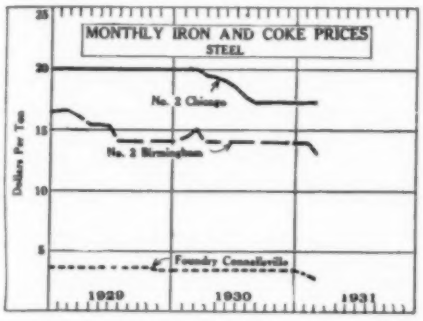
An Eccentric Gear Oscillates the Specimens Back and Forth Across the Polishing Disk

Trade Trends in Tabloid

FOUNDRY operations generally have remained at about the same level during the past two weeks. However, at least one exception is noted in the Milwaukee district, where a heavier demand for castings has developed recently.

—T—T—

Automobile production continues its upward trend, with March production estimated at 290,000 units. Production of cars and trucks in February, according to the National Automobile chamber of commerce, increased nearly 30 per cent. Total



output in February reached 230,364 cars and trucks, compared with 178,399 in January and 345,955 in February, 1930.

—T—T—

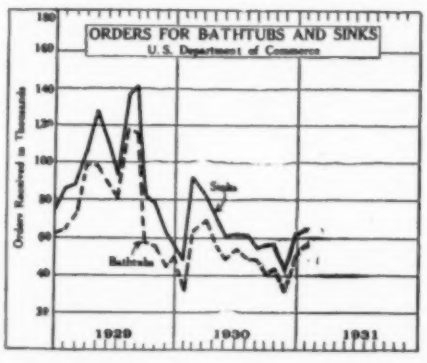
The cast iron pipe industry in the Birmingham district is operating at about 70 per cent.

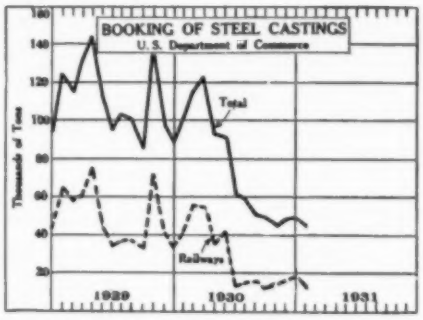
—T—T—

Production of malleable castings in January, according to the department of commerce, totaled 31,357 tons compared with 30,431 tons in December and 61,381 tons in January last year. Orders booked increased from 26,433 tons in December to 32,633 tons in January.

—T—T—

Mild gains in operating schedules in some of the jobbing foundries have been countered by losses in other casting shops, so that the rate for the Chicago district still is estimated at not more than 40 per cent Several of the steel foundries have been getting more railroad supply and implement orders. Aluminum





foundries are fairly active. More shops are casting on a 5-day basis than at any time since last September.

—T—T—

February orders for machine tools showed an encouraging improvement over January.

—T—T—

Loadings of revenue freight cars reached the highest point of the year for the week ended March 7, according to a report of the American Railway association, with a total of 732,534 cars compared with 682,000 cars during the previous week.

—T—T—

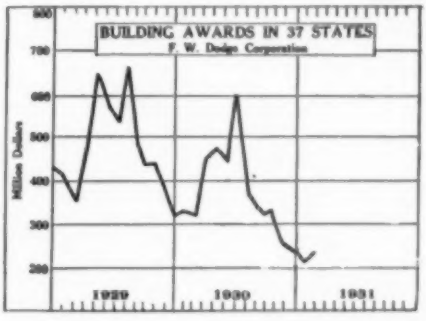
According to the Steel Founders' Society of America, 60 per cent of members reporting are operating below 50 per cent, 18.5 per cent from 50 to 59 per cent of capacity, 9.2 per cent from 60 to 69 per cent, 9.2 per cent from 70 to 100 per cent and 3.1 per cent over 100 per cent of capacity. Approximately 67 per cent of the reports indicate that the business outlook is fair, while 4 per cent state future possibilities are good.

—T—T—

Orders for bath tubs in January increased according to the department of commerce. The total for the month was 56,494 units compared with 52,254 in December. Orders for sinks increased from 61,567 units in December to 63,074 in January.

—T—T—

Index of gross orders for foundry equipment in February was 54.71



compared with 65.3 in January. Index of shipments increased from 54.69 in January to 55.36 in February.

—T—T—

Foundries in the St. Louis district continue to hold the gains in operating schedules recently reported.

—T—T—

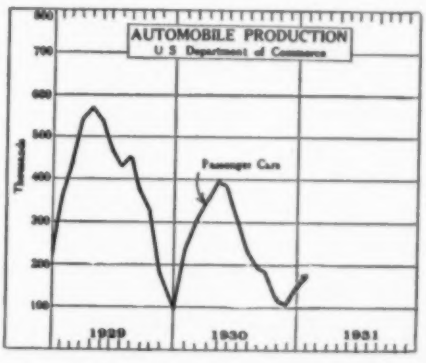
Construction awards for February totaled $235,405,100 compared with $227,956,400 in January and $317,053,000 for February, 1930, according to the F. W. Dodge Corp.

—T—T—

Gray iron foundries in New York and Northern New Jersey are operating at from 40 to 50 per cent of capacity. Malleable shops are working slightly below this general rate. Brass and bronze foundries show but little improvement, except in one or two cases where attractive building orders have been secured. Cast iron pipe foundries in the east have increased operations to around 60 per cent, due largely to seasonal buying.

RAW MATERIAL PRICES
March 19, 1931

Iron	
No. 2 foundry, Valley	$17.00
No. 2 Southern, Birmingham	12.00 to 13.00
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.50
Basic, Valley	17.00
Basic, Buffalo	17.00
Malleable, Chicago	17.50
Malleable, Buffalo	18.00
Coke	
Connellsville beehive coke	$3.25 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$12.00 to 12.50
Heavy melting steel, Pitts.	12.50 to 13.00
Heavy melting steel, Chicago	9.75 to 10.25
Stove plate, Buffalo	9.50 to 10.00
Stove plate, Chicago	7.75 to 8.25
No. 1 cast, New York	8.00 to 8.50
No. 1 cast, Chicago	9.50 to 10.00
No. 1 cast, Philadelphia	13.00
No. 1 cast, Pittsburgh	12.50 to 13.00
No. 1 cast, Birmingham	11.50 to 12.00
Car wheels, iron, Pittsburgh	13.50 to 14.00
Car wheels, iron, Chicago	10.50 to 11.00
Railroad malleable, Chicago	12.00 to 12.50
Agricultural mal., Chicago	10.50 to 11.00
Malleable, Buffalo	12.00 to 12.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	9.75 to 10.00
Straits tin	27.40 to 27.50
Aluminum, No. 12, producers	22.00
Aluminum, No. 12, remelt	11.00 to 11.50
Lead, New York	4.50
Antimony, New York	7.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.00



What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

General offices of the Fuller-Lehigh Co. have been transferred from Fullerton, Pa., to 85 Liberty street, New York.

The pattern works of Vincent Schnorberger, Monroe, Mich., recently was damaged by fire to the extent of $15,000.

Efficient Foundry Inc., 128-130 Bleecker street, New York, has discontinued business.

C. H. Steel, in care of Orange Car & Steel Co., Orange, Tex., is representing a company planning to establish a gray iron foundry at Port Arthur, Tex.

The plant of the M. I. Viau & Sons Foundry Co., St. Jerome, Que., recently was damaged by fire. The loss is estimated at $20,000.

Buckeye Foundry Co., 2257 Buck street, Cincinnati, is building a new foundry at Beekman & Denham streets. (Noted Dec. 15, 1930.)

Gould Coupler Co., Depew, N. Y., was the successful bidder on 68,110 pounds of steel castings for the engineering department, borough of Manhattan, New York.

Houston Foundry & Machine Co., Houston, Tex., has been incorporated with $300,000 capital by A. J. Binz, Binz building, to operate a steel foundry.

Henry Furnace & Foundry Co., Medina, O., is reported to have sufficient orders on hand to keep the plant busy until next December.

Pritchard & Andrews Co., 264 Sparks street, Ottawa, Ont., recently began the production of brass and aluminum castings. H. M. Pritchard is secretary.

Standard Castings of Cincinnati Inc., 1738 Powers street, Cincinnati, is operating at about 80 per cent capacity. E. F. Rogers is manager.

Smith Steel Castings Co., Jefferson street, Anderson, Ind., advises through K. Smith, president, that all equipment and machinery has been secured except small tools. (Noted March 1.)

The plant of the Superior Foundry & Mfg. Co., Twenty-ninth street and Alton Park boulevard, Chattanooga, Tenn., recently was damaged by fire. The loss is estimated at $2250.

G. W. West Foundry & Machine Co., Philadelphia, has been incorporated by David H. H. Felix, 1416 South Penn square, to manufacture articles of iron and conduct a foundry business.

Springdale Foundry Co., Springdale, Pa., has been incorporated with $50,000 capital by George Chismark, West Seventh avenue and Mill street, Tarentum, Pa., to manufacture and sell iron, steel, brass and other metal castings.

Miller Corp. of America, 1545 Temple avenue, Detroit, has been incorporated with $2000 capital by J. P. Waldecker, 2157 Lansing street, to manufacture and sell castings, machine work and patterns.

Getchell Foundry & Machine Co., Oakland, Me., C. W. Getchell, manager, plans to rebuild its one and 2-story plant recently damaged by fire. The cost is estimated at $50,000. (Noted Feb. 15.)

Advance Foundry Co., 100 Parnell avenue, Dayton, O., has closed bids for the construction of a storage unit and is having plans prepared for a plant addition. C. A. Hock, 309 Realty building, is architect.

F. T. Daly, whose foundry on Northern avenue, Vancouver, B. C., recently was severely damaged by fire, has secured a site on Lulu Island and will start work immediately on the erection of a new plant.

Industrial Committee of the chamber of commerce, Wellsboro, Pa., has initiated negotiations for securing a foundry and machine shop, equipped for the manufacture, repairs and maintenance of gas equipment.

American Steel Foundries, Thirty-sixth and Smallman streets, Pittsburgh, has secured a building permit for the erection of a crane runway at the cost of $5000. Contract is held by Pittsburgh Bridge & Iron Works, Fulton building, Pittsburgh.

Inland Iron Works Co., Okmulgee, Okla., has been organized by officials of the Joplin Machinery & Electric Co., Joplin, Mo., to operate a plant in Okmulgee with a foundry for the production of aluminum, brass and bronze castings. L. T. LeBow is president.

Harry C. Weiskittel & Co. Inc., Baltimore, will proceed with the erection of a gas range manufacturing plant in that city. The site covers 24 acres. A plant and office unit to be erected will be 180 x 300 feet. Later construction will include an assembly plant, 80 x 260 feet. (Noted Feb. 15.)

Lake Erie Engineering Corp., 268 Perry street, Buffalo, manufacturer of boilers, machinery and castings, is moving to make way for a terminal development. Plans are being drawn for a new plant to be erected in the Tonawanda district and contract is to be awarded soon. Occupancy is planned for Aug. 1. The cost of the project is estimated at $300,000.

Wisconsin Art Bronze & Iron Co., Milwaukee, has been organized by W. C. Schmeling, formerly assistant general manager, Wisconsin Ornamental Iron & Bronze Co., division of General Bronze Corp. A new plant is being established at 247 East Keefe avenue and production will begin at once. Fred Van Kooy and A. R. Stark are associated in the enterprise.

Sibley Machine Works, South Bend, Ind., soon will let contracts for a 1-story foundry unit, 80 x 100 feet. According to B. J. Voll, general manager, the company will not purchase any machinery or equipment at present. Plans for the unit were made by Frank D. Chase Inc., 720 North Michigan avenue, Chicago, who recently awarded the general contract to Ralph Solitt & Sons Co., South Bend, Ind.

Jenkins Bros. Ltd., 615 St. Remi street west, Montreal, Que., which recently was reported ready to begin the construction of a new foundry at Lachine, Que., as the first unit of a new plant to which operations are to be moved, advises through James H. Webb, vice president and managing director, that bids have not yet been called for the new unit. The erection of the iron and brass foundry is planned for next summer. Ross & MacDonald, 601 Belmont street, Montreal, are the architects. (Noted Nov. 15, 1930.)

Cooper Alloy Foundry Co., 150 Broadway, Elizabeth, N. J., has organized to take over the Wm. J. Sweet Foundry Co., Newark, N. J., which recently suspended operations. The former company has a completely equipped foundry and will specialize in the production of corrosion and heat resisting alloys including chrome and chrome nickel irons, monel metal, etc. The complete organization of the former Sweet company has been absorbed by the new firm. The new company also will continue to manufacture a group of alloys known under the trade name Sweetaloy. Harry A. Cooper, formerly president, Wm. J. Sweet Foundry Co., is president of the Cooper Alloy Foundry Co.

Castings of Canada Ltd., Ottawa, Ont., has been incorporated with $250,000 capital by Norman McCallan, to carry on the business as iron master and manufacturer of steel and iron. The company advises through Fred C. Clayton, president and general manager, that its main office is located at 418 Sparks street, Ottawa, but that all mail should be addressed to Smith Falls, Ont., where a plant is being established. No. 2 plant of the Smith Falls Malleable Castings Ltd. has been leased for the production of leakproof unions and other malleable cast iron products.

Trade Publications

LIFT TRUCKS—Illustrations of the latest power lift trucks made by the Crescent Truck Co., Lebanon, Pa., are included in a recent folder issued by the company. The equipment is shown in typical applications.

RESINOUS BINDER—A folder issued by General Plastics, Inc., North Tonawanda, N. Y., describes a core binder incorporating a phenolic condensation product. Advantages of the product in working and baking are outlined and a typical example of a core made with the binder is illustrated.

WIRE ROPE—Hazard Wire Rope Co., Wilkes-Barre, Pa., recently has issued a folder presenting the advantages of a wire rope product made from 18-8 chrome-nickel, stainless steel. Classes of service to which the rope is adapted are outlined, its construction described, and its resistance to corrosion emphasized.

FURNACES — Portable, box-type, electric heating furnaces made by Ryan, Scully & Co., Philadelphia, are illustrated and described in a recent bulletin. The furnaces range from 6 to 96 kilowatts in power and are arranged for various industrial applications. Engineering specifications are given for two standard size ranges and special features of the design pointed out.